THE

HISTORY, STRUCTURE, ECONOMY AND DISEASES

OF

THE SHEEP

BY

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Fifth Edition

CAREFULLY REVISED AND CONSIDERABLY ENLARGED

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ADVERTISEMENT

TO

THE FIFTH EDITION.

In issuing a new edition, the Publishers regret to have to record the death (in May, 1885, in his seventy-seventh year) of the esteemed Author of this work, who for many years had enjoyed a very high reputation in his profession.

The fact that the present work, which is now considerably enlarged and extended from its original form, has for upwards of thirty years held the highest place as an authoritative exposition of its subject, is in itself conclusive evidence of its value. The work had the advantage of full and careful revision at the Author's hands in the latter years of his life; and amongst the testimonies to his professional distinction which appeared in the press at the time of his decease, were included several recognitions of the fact that this work on "The Sheep" had been brought up by him to the present state of scientific and practical knowledge, entitling it to retain its recognised status as the best manual for practitioners and for all who are interested in the subject of which it treats.

It is perhaps needless to mention the well-known fact that, besides the special subject of this volume, Mr. Spooner was recognised as a leading authority upon all matters connected with live farm stock generally.

PREFACE

TO

THE THIRD EDITION.

It rarely occurs that an Author is called upon to prepare a new edition of a book first published thirty years ago, and it cannot be surprising that such a work should demand considerable revision and addition. In supplying these wants, the same purpose which influenced the Author in the preparation of the original work obtains likewise with reference to this new edition : that is, to prepare a really useful and reliable book, and yet to keep within a certain allotted space.

Whilst the anatomical and physiological portions have required but little alteration, both the historical and pathological divisions have demanded considerable additions. In the former, new breeds have sprung into existence, or been moulded into distinct characteristics by intelligent and observant breeders ; and in the latter, the experience of thirty years has brought new observations to the fore, and developed new ideas either controverting or supporting old theories, or exploding certain errors, and bringing to light important facts.

Amongst the most laborious and the most successful of the explorers after truth in this department, the post of honour must undoubtedly be assigned to Professor Simonds, a fellow-pupil of the Author, and now Principal of the Royal Veterinary College. From his numerous communications to the Council, or its valuable publication, the " Journal of the Royal Agricultural Society of England," the author has freely quoted, using as much as possible the language of the writers. On subjects, however useful, relating to the diseases of a particular class of animals, he has felt that the best compliment that could be paid to the writers of valuable articles was to diffuse, as much as possible, their facts and observations.

PREFACE

TO

THE FIRST EDITION

THE following pages are intended to furnish a manual of the various breeds and the structure and diseases of sheep—easy of reference and readily accessible—for which purposes each portion of the work is separately arranged. No one can be more sensible than the Author of the defects with which, in common with the productions of all preceding writers on the same subject, the present work may be charged—defects arising from the very slight attention which has been paid by men of science to the diseases of the sheep, and the want of correspondence and co-operation amongst those whose opportunities have afforded them the means of practical information.

The information derived from works of authority, and incorporated in the present work, require no apology, the Author's object having been to furnish on each branch of his subject the best information; he has, therefore, taken advantage of all accessible and well-authenticated facts, and in most cases has employed the language of the writers, as well as given their names. Justice to them and to the subject required that this should be done. The diseases of sheep are so frequently of an endemical character, and are so modified and governed by the influence of the breed, the mode of management, and the locality, that if any writer, however extensive his opportunities, relied solely on his own experience, his work would possess at best but local interest and value.

The book is divided into three parts. The first, which embraces the history of the breeds of sheep, is arranged somewhat according to the plan adopted by Professor Low in his work on the Breeds of Cattle and Sheep; and the Author has availed himself of this book in the account of the various races of sheep found in the northern parts of the island; whilst he has relied principally on his own knowledge for the description of the more southern breeds. The most important portion of the anatomical division of the work has been the result of careful dissection; and for the sections on feeding, fattening, and breeding, the Author is alone responsible. In the third part, on the diseases of the sheep, free use has been made of the pages of the 'Veterinarian: whilst the elaborate treatise on sheep by its principal editor, Mr. Youatt, has been carefully perused and compared.

The Author flatters himself that he has, in a small compass, brought the various branches of his subject up to the present period, and that it will be found, by the large and important class it concerns, of practical utility.

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THE HISTORY, STRUCTURE, ECONOMY, AND DISEASES OF THE

SHEEP.

PART I.—THE BREEDS OF SHEEP.

THE ORIGIN AND ANCIENT HISTORY OF THE SHEEP.

THE origin of the Domestic Sheep is involved in much obscurity, but naturalists find amongst the wilder races of animals some strong marks of affinity; and on the same hypothesis that the wolf and the jackal, the hyæna and the fox, were the ancestors of the dog, they assign the progenitorship of the domestic sheep to the Argali, or Wild Sheep of Asia, and the Musmon of the South ot Europe and of Africa.

'The *Argali*,' observes Professor Low, 'possessing the generic characters of the sheep, is somewhat less than the size of a stag. He has enormous horns, measuring more than a foot in circumference at the base, and from three to four feet in length, triangularly rising from the summit of the head so as nearly to touch at the root, ascending, stretching out laterally, and bending forward at the point. He has a fur of short hair, covering a coat of soft white wool. The colour of the fur, externally, is brown, becoming brownish grey in winter; there is a buff-coloured streak along the back, and a large spot of a lighter buff-colour on the haunch, surrounding and including the tail. The female differs from the male in being smaller, in having the horns more slender and straight, and in the absence of the disc on the haunch. In both sexes the tail is very short, the eyelashes are whitish, and the hair beneath the throat is longer than on any other parts of the body.

'These creatures inhabit the mountains and elevated plains of Asia, from the Caucasus northward and eastward, to Kamtschatka and the Ocean. They are agile and strong, but very timid, shunning the least appearance of danger; their motion is zigzag, and they stop in their course to gaze upon their pursuer, after the manner of the domestic sheep. They are usually found in very small flocks, and at the rutting season the males fight desperately, using their horns and forehead in the manner of the common ram. They are hunted by the people of the country for their flesh, which is esteemed to be savoury, and for their skins, which are made into clothing. In autumn, after having pastured during the summer on the mountains and in the secluded valleys, they are fat, and in high request; but as winter advances, they are forced to descend from the mountains in search of food; they then lose their plumpness, and are sought after only for their skins. When taken young they are easily tamed, but the old ones never resign their natural wildness.'

Allied to this species, or identical with it, is the Rocky Mountain Sheep, or Argali of America. This creature inhabits the loftiest mountain chains of North America. It is described by Spanish writers as the sheep of California, and is familiar to the Indians and fur-traders of Canada. It surpasses the Asiatic Argali in size, and is consequently taller than the largest of our domestic sheep. Its horns are very large, approaching, but not touching, one another at the base. The horns of the female are small, and slightly curved. The fur is of a reddish brown colour, but becomes paler in winter, and in spring the old rams are nearly white. The face and nose are white, and the tail and buttocks present the buff-coloured disc which distinguishes the male of the Asiatic species. They collect in flocks under the guidance of a leader. They pasture on the steepest parts of the mountains, and on the approach of winter descend into the plains. They are wild and timid, betaking themselves on the least alarm to the summits of the mountains. They are pursued and killed by the Indians for their flesh and skins, and have never been subjected to domestication.

The *Musmon* still inhabits the Islands of Crete and Cyprus, and the mountains of Greece. It is found in Corsica and Sardinia, where it is familiar to the mountaineers of the interior. It formerly abounded in Spain, and even yet it is said to be seen in the mountains of Murcia.

The Musmon is smaller than the Argali. In the male the horns are two feet in length; in the female they are often wanting. They are very thick; and they turn inward at the points, in

which respect they differ from the horns of the Argali, which bend outward. The fur consists of a brownish hair, concealing a short fine grey-coloured wool, which covers all the body.

The Musmons resemble the Argalis in several characters, but they are less powerful and hardy, and inhabit a lower range of mountains. They are gregarious, assembling in large herds during the summer months; but at the rutting season fierce contests take place between the rams, and the herd divides into smaller bands, consisting of a male and several females. The Musmon is with difficulty domesticated. Judging from the specimens which have been captured and retained in a state of confinement, they are less docile and sensible of acts of kindness than the domestic sheep. The Musmon has been known to breed with the domestic sheep, and the offspring is fruitful. Pliny mentions such alliances as common, and states that the progeny were termed Umbri.

Whether the hypothesis be correct or not that the domestic sheep is descended from the wilder animals thus described, it is evidently the fact that if so, they must have been domesticated, and their habits materially changed, at a very early period. For my own part, although ready to acknowledge that the Argali, the Musmon, and the Sheep may be descended from a common parentage, it is no more difficult to imagine that these wild animals may owe their origin to an animal resembling our mountain sheep, than that the latter should be descended from them; but it appears still more reasonable to believe that both the domestic sheep and the wild Argalis, &c., are descended from an animal of an intermediate state, neither so wild and active as the one, nor so quiet and docile as the other; but the nature and habits of each receiving a different direction, from the one becoming domesticated, and the other wild, until, in the course of time, from the influence of the soil, the pasturage, and other local circumstances, the very different animals may be produced which now appear.*

Such view is, I imagine, more in keeping with the inferences to be drawn from Scripture history with regard to the early domestication of the sheep. Abel, we are told, was a keeper of sheep, and it was one of the firstlings of his flock that he offered unto the Lord, and which, proving a more acceptable sacrifice, excited the implacable and fatal jealousy of his brother Cain.

Ere the soil could be cultivated to any great extent, or the mechanical arts advantageously practised, or the precious

* We must refer those who wish to speculate further on the origin of the sheep, to the works of the illustrious Darwin, 'Animals and Plants,' and the 'Origin of Species.'

metals became a source of gain, whilst population was thin and labour necessarily scarce, the cultivation of sheep afforded the ready means of increasing the comforts of man, and, in many communities and localities, laid the foundation of future wealth and prosperity. Endowed by nature with a peaceable and patient disposition, and a constitution capable of enduring the extremes of temperature, adapting itself readily to different climates, thriving on a variety of pastures, economizing nutriment where pasturage is scarce, and advantageously availing itself of opportunities where food is abundant, this animal afforded one of the most profitable and pleasing, as it was evidently one of the most ancient, pursuits of man. Driven, or rather led about, from mountain to mountain, and from plain to plain, these ancient flocks of sheep supplied their possessors with both food and raiment. In the very earliest period the milk became their first and most profitable application, being either used in its natural state, or converted into cheese; the skins, too, were employed as garments for the body, as well as coverings for the tents. The flesh was only occasionally used as food. These probably were the earliest purposes to which sheep were devoted; and at the present day they still form, amongst many uncivilized tribes, the only uses that are known; these tribes being, in fact, inferior in their knowledge of the domestic manufactures to that possessed by most of the Bible patriarchs, who were acquainted with the use of the fleece, independent of the skin, as may be illustrated by the coat of many colours, which the paternal partiality of Jacob constructed for his favourite son Joseph.

A pastoral life was one of the most favourite employments of the ancient patriarchs, and it is spoken of in the Scriptures with the greatest respect. Abraham was a possessor of flocks and herds; Isaac pursued a similar occupation; and Jacob for fourteen years tended the flocks of his covetous relative Laban, before he was rewarded by the possession of his beloved Rachel, or became the owner of flocks himself. The character of Laban is drawn with graphic force; and on reading an account of this wealthy but mercenary man, the mind reverts to hundreds such as have lived since his time, and even to the present day. Jacob, we have said, made a coat of many colours, and Laban went forth to shear his sheep; the manufacture of cloth must, therefore, have been known, rude as it may have been, and the felting property of wool could not have been undiscovered.

It is a singular, though not an unpleasing circumstance, that the manners and customs of the patriarchs have become, as it were, indigenous to the soil on which they lived. In the same

land where Laban sheared his sheep, and Abraham sat at the door of his tent, viewing his flocks and his herds—where the beauteous Rebecca drew water for her father's sheep, and Jacob mourned for the loss of his beloved son—in the same land, the wandering Arab, or the wild Turcoman, still tends, probably, the very animals descended from the patriarchal flocks and droves, or leads them from pasture to pasture, watering them, and tending them in the same manner as their progenitors were tended four thousand years before. Proof of the correctness of the descriptions in Scripture—the best evidence that they were drawn from life itself—is indeed afforded by the manners and customs of these pastoral people, who, whilst all the world around them have changed, themselves have remained comparatively the same.

Whenever a country possessed proper pasturage, sheep were invariably introduced with civilization itself; thus, though Asia, and particularly its western part, was for many years the nursery of this profitable animal, it was probably introduced into the eastern and southern part of Europe with its earliest civilization. Greece alone for many years possessed this valuable animal, and it is accordingly shown by the writings of its poets and historians how highly it was esteemed. After the foundation of Rome it was introduced into Italy, but it was many years afterwards before shearing was practised, though the barbarous practice of plucking was often employed. With the conquests of the Romans the use of the sheep was extended into the conquered countries. The thick forests of Germany forbade their rapid progress, but Spain afforded an abundance of open pasture well adapted for sheep, which probably were previously introduced into this country from Africa; thus Spain became celebrated in the time of the Romans for the quality of its wool, and it has retained its pre-eminence in this respect over all other countries till the present century, when it has yielded the palm to the wools of Germany.

The fleece of the sheep naturally consists of both hair and wool; in some hot countries the hair predominates, and in the wilder races the wool may be plucked off annually, leaving the hair on the skin. The colour of the wool is supposed to have been naturally of a dark hue; in wild races it is presented of all colours, and the white hue of our present flocks is owing to the constant habit of breeding only from white parents.

'The sheep of Europe,' observes Professor Low, to whom we are principally indebted for our account of the foreign breeds, 'are wonderfully diversified. A remarkable character which distinguishes the sheep of several regions is the accumulation of fatty matter on particular parts of the body. Fat, we know, is a

secreted tissue, which intermingles with and surrounds the muscular substance, and which envelopes the viscera within the body. A large part of it is usually found beneath the skin, more or less thick on different parts of the body, as the rump, the flanks, and the shoulders; but in the sheep of certain countries it accumulates greatly on the posterior parts, namely, the rump, or the tail, just as in the ox of certain countries it accumulates on the shoulder. In the races of sheep which extend from Circassia and Georgia, over Asia Minor, Syria, and Arabia, the tail is broad as well as long, and is covered with fat to its extremity, where it terminates in a point. The fat accumulates sometimes on this tail to such a degree as to form a large part of the weight of the animal. It is of a soft oily substance, and is used in those countries in place of butter or oil. Some of these sheep are brought to England from time to time under the name of Turkish Sheep. But that monstrous accumulation of fat which we see in some of them seems to take place chiefly when they are kept in yards or houses. They then become very large, and the excess of fatty matter accumulates on the tail, where it may be supposed to be less injurious to the animal in a warm country than were it extended over the other parts of the body. In Africa the same character prevails, but in races of sheep entirely distinct from the Syrian.

'Northward of the Caucasian range, the sheep are to be found short-tailed, with the fat accumulated on the haunches, forming two great cushions. This character is the most remarkable in the races near the Black Sea and the Caspian; but it extends over a part of Asiatic Tartary and Russia in Europe, becoming less prominent however as we recede from those seas, and ultimately disappearing. Pallas conjectures that this character arises from the sheep feeding on the bitter and saline plants found in the countries on the Black Sea and the Caspian; and he asserts that, when they are removed from the places where these plants grow, the fatty excrescence becomes less. It may justly be assumed, indeed, that this character is the result of peculiarities of food, although we cannot determine physiologically in what manner the effect is produced.

'A race of sheep exists in Persia, and to the north of it, which deserves to be mentioned, as being, perhaps, the nearest in its character to the wild species. There are, indeed, various races in Persia, but this peculiar race is proper to the northern parts of the country on the Caspian, and is greatly diffused. It is covered with a very coarse hairy wool of a grey colour; its horns are bent outwards in the manner of the Argali, and, what is worthy of note, its head resembles the common figure of the ram, as

depicted in Eastern sculptures. This original race is the most diffused of any in the world, extending across the Indus over a great part of Hindustan. It is to be distinguished, however, from another very remarkable one found likewise in Persia, which is destitute of tail, and has an accumulation of fat upon the posterior parts. This breed is frequently termed the Persian, but its principal habitat is the shores of the Red Sea, and it seems to be of African rather than Asiatic origin. It is by some termed the Abyssinian Sheep.

'The Tartar sheep have usually horns and pendent ears; they are strong and hardy, but they are of bad form, and have coarse wool. The finest woolled sheep of this race are said to be produced in the Crimea; but this is partly the result of crossing with the Spanish Merinos. Many of the Tartars under the Russian dominion have vast flocks of sheep, amounting to many thousands. The sheep of Astracan, on the Caspian Sea, are noted for the fine furs which they produce; but these furs are the skins of lambs taken from the mother before the natural birth.'

Proceeding northwards through the Russian dominions in Asia and Europe, the wool of the race there found is much mixed with coarse hair. Sometimes, however, the wool covered by this hair is fine, as in the sheep of the Feroe Islands.

The sheep of Europe seems to be of a more mixed descent than those of a great part of Asia. The original Celtic nations had their sheep, though few in numbers, while their conquerors may be supposed to have brought with them the sheep of the countries from which they emigrated, and hence the mixture of races. The sheep of Africa, too, have been from time to time mixed with those of the south of Europe. In European Turkey and Greece, the sheep do not correspond with their ancient form. They are of small size and indifferent form. They are often of the flat-tailed variety, exhibiting in this respect an affinity with the sheep of Asia Minor and the adjacent countries. In the Islands of the Archipelago few sheep are reared. Some of them are of the Syrian breed, having long fat tails. But there is a peculiar race existing in some of the islands, which have several horns, and long hairy wool.

Ascending the Danube, the sheep are found to be of the long-tailed variety, although without any tendency to a fatty enlargement of the tail. The breed of Wallachia may be regarded as the type of a race which extends through Moldavia, Transylvania, and westward to Vienna. This breed has black faces, and long wiry wool, much mixed with hair. It resembles in certain characters the Persian breed, and the Black-faced Heathy breed

of Scotland. Italy, once so renowned for its sheep, can now boast little of this production of her bounteous clime. The Romans, whose dress was woollen, cultivated in an especial degree the fineness of the fleece; and it was not until the days of the Empire that the silk and cotton of the East began to supersede the ancient raiment of the Roman people. The finest wools of Ancient Italy were produced in Apulia and Calabria, being the eastern parts of the kingdom of Naples. Pliny informs us that the best wool was that of Apulia, on the Adriatic Sea; and the next best was further to the south, on the Gulf of Tarentum; and the Milesian or Asiatic sheep carried the third prize; and that for whiteness, there was none better than that produced on the Po. The care of the Romans in causing the wool to grow fine exceeded, in the case of certain breeds, anything that is now attempted. The sheep were kept in houses, and continually clothed, so that the filaments of the wool might become delicate; the skin was smeared with fine oil, and moistened with wine; the fleece was combed so that the wool might not become matted, and the whole was washed several times in the year.

This excess of care proved rather injurious to the sheep, rendering them tender and more disposed to disease. With the fall of the Empire these choice breeds were neglected and lost, and though there are still a few fine-woolled sheep in Italy, they are neglected and badly formed. This is also the case with regard to Sicily, which was once celebrated for the fineness of its wool, and still retains some fine-woolled sheep.

Of all the countries in Europe, says Mr. Low, Spain has been the longest distinguished for the excellence of its wool. This fine country, more varied in its surface and natural productions than any other region of the like extent in Europe, produces a great variety of breeds of sheep, from the larger animals of the richer plains, to the smaller races of the higher mountains and arid country. Besides the difference produced in the sheep of Spain by varieties of climate and natural productions, the diversity of character in the animals may be supposed to have been increased by the different races introduced into it:—first, from Asia, by the early Phœnician colonies; secondly, from Africa, by the Carthaginians, during their brief possession; thirdly, from Italy, by the Romans, during their dominion of six hundred years; and fourthly, again from Africa, by the Moors, who maintained a footing in the country for nearly eight centuries. The large sheep of the plains have long wool, often coloured brown or black. The sheep of the mountains, downs, and arid plains have short wool, of different degrees of fineness, and different colours. The most important of

these latter breeds is the Merino, now the most esteemed and widely diffused of all the fine-woolled breeds of Europe.

There are many varieties of sheep naturalized in different parts of Europe, the great portion of which are of the long-tailed sort; the short-tailed kinds, however, exist even in the northern parts of this country, having been imported from Scandinavia, and long cultivated by the Sclavonic nations. These sheep are to be distinguished from those belonging to the descendants of the Celtic tribes, having, like their owners, altogether a distinct descent. They are interesting as affording a strong contrast with our improved breeds, and serve to show by comparison the superior points of the latter; they will, therefore, first come before our attention.

The history of sheep in this country is coeval with its earliest records. In the times of the Romans the wool of Britain was sought after as an object of luxury in the capital of the empire. A manufactory was established at Winchester, and its fabrics became a subject of panegyric to the historians of Rome. What the nature of the original breed of Britain was it is impossible to determine; it had no doubt become considerably modified by the variety of pasturage this country affords ere history first takes up the subject, and there was in all probability then, as now, a very different class of animals located on the rich pastures of the midland counties to that spread over the widely-extended downs of the southern districts, whose aspect, in all probability, was not very dissimilar to that afforded at the present time. It is, however, extremely probable that it was the long coarse wool that is so commended by the Roman writers, as at that time Spain afforded a nearer market, and produced a description of wool considerably finer and better adapted for clothing purposes. And it must be borne in mind that at this period wool formed the staple commodity for the clothing of the rich, the cotton manufactory was then unborn, and the importation of silks from the East had not been carried on to any extent. At a later period, however, the eastern colonies afforded a lighter and pleasanter garment for a warm climate, and then fine wool became less in demand.

The origin, and indeed the earlier history, of the different breeds of sheep in this country is altogether lost in obscurity. We know that certain breeds existed in certain places at a particularly early period, and this is nearly all we can obtain as to their origin. From this period, however, we are enabled to trace the different breeds through various countries, and to ascertain the sources of the various improvements which have been made in the flocks of this and other countries. For this purpose it will be desirable to give a brief history of the principal and a slight sketch of the

other breeds existing in this country; and in so doing we cannot do better than give priority to the wilder and unimproved breeds, in order to illustrate better, by comparison, the improvements that have been effected by systematic breeding and nutritious food in the more favoured breeds, whose history will follow. With this view we commence with an account of the breed of the Orkney and Zetland Islands.

THE BREEDS OF SHEEP.

The Short-tailed Sheep.—The short-tailed sheep are little wild animals, located in the Orkney and Zetland Islands, and the Hebrides, and they probably came from the opposite coast of Norway. Somewhat similar to the goat in appearance, they resemble this animal likewise in their habits, in their activity, their hardihood, and their partiality for mountainous spots. The fleece consists of both wool and hair, the former not increasing in length from year to year, as other sheep, if not sheared, but coming off as the summer approaches, leaving the hair alone at this period of the year. The fleece therefore is not sheared; the wool is plucked with the hand, and thus readily separated from the hair. It is very fine and soft, but not adapted for felting. The fleece weighs only from one to two pounds. The purest breeds are found in Zetland, those of Orkney being more frequently mixed with other breeds, particularly with the Dutch, by which admixture the wool is rendered less fine. The pure breeds are of various colours—black, brown, grey, and white, and often spotted; both sexes have horns, but more frequently they are absent in the female. The horns are short and upright, resembling those of the goat. Exposed to every vicissitude of the weather, which in these remote and sterile islands is of the most rigorous kind, neglected by their owners, deriving their subsistence from the heath, the marine plants, or what little vegetation can be obtained in these barren spots, their size is stunted, and the wethers when fat do not exceed six or seven pounds the quarter. They exceed perhaps all other kinds in their power of enduring the rigour of the weather and scantiness of food. They will even subsist on animal food, such as dried salt fish, when nothing else can be obtained. These little animals are rendered wilder by the neglect of their owners, and vast numbers of them are thereby lost, and when a sheep is wanted it is common to hunt it down with dogs. The rams are pugnacious, and will often attack and destroy the ewes, so that, all circumstances combined, little profit accrues to the owner.

The spirit of improvement has, however, found its way into these remote islands, and with the improved attention to the cultivation of the soil, attempts have been made to improve the race of sheep. For this purpose, crosses of the Merino have been tried, but with little success, the produce becoming too delicate. Other races have been employed, but the Cheviot only with decided improvement. There has been little or no attempt made to improve the original breed itself by the careful selection of the parents; and we may expect that with the improvement of husbandry the ancient breed will in a great measure be supplanted by more improved animals.

The Sheep of Wales.—Though in the valleys and fertile pastures of Wales there are found many of the improved English breeds of sheep, the Leicester and the South Down, yet the mountains of the Principality possess two distinct varieties, which are naturalised to the soil. Professor Low distinguishes them, the one as the *Sheep of the Higher Mountains*, and the other as the *Soft-woolled Sheep.*

The former is very small, seldom exceeding five pounds the quarter, with horns in both sexes resembling the goat, whose habits it otherwise resembles. The tail is of the usual length, and there is a ridge of hair on the back, throat, and dewlap, and the fleece is of various colours, black, grey, and brown. These sheep are extremely active and wild, and prefer the highest spots and the aromatic plants found there to richer herbage. They abound mostly in South Wales. Like those of Orkney and Zetland, the rams often attack the ewes when in lamb, and thereby diminish their number, as if for the purpose of repressing their too great increase.

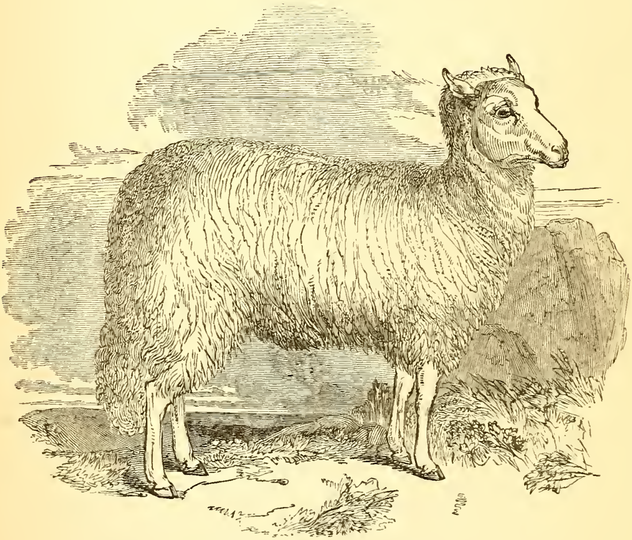
They have black hair on the face and legs, a character which continues even in their improved state, as in the Radnor, a superior variety of the same race, enlarged by better pasturage. These sheep would be improved by crossing with either the South Down or the Cheviot, though the hardier characteristics of the latter would probably render it more suitable for the purpose.

The Soft-woolled Sheep may be considered as the distinctive breed of Wales, and is distinguished from others by the whiteness of the nose as well as the face. The fabric known as Welsh flannels is derived from the wool of this breed, and the flesh is still more celebrated under the well-known term of Welsh mutton.

These sheep are small, seldom exceeding eight pounds the quarter when fat. They are spread throughout the whole of Wales, but delight in lofty situations. Like all mountain breeds, their habits are exceedingly active, and when enclosed, few fences can

confine them; even when removed to distant spots they will not unfrequently escape and regain their native mountains.

Their form corresponds to their habits, being slender throughout, and their hind-quarters long, like those of the deer. The males have their horns curved backwards, but the females do not possess any. The neck is thin, and arched backwards, like the deer, in a greater degree than any other sheep. They have a mixture of hair, though less than other mountain breeds, and this is particularly noticeable on the throat, where it appears like a beard. The fleece weighs between one and two pounds, partakes of the



THE SOFT-WOOLLED WELSH SHEEP.

long-wool character, and is well adapted for flannels or hose, but not for cloths, although used for this purpose in the domestic manufactures, which, however, the more advantageous employment of machinery is rapidly superseding. It is a frequent custom to clip off the wool of the neck and face before the winter, as, if left, it often comes off without assistance.

These sheep are also found in the Island of Anglesea, where, however, from better pasturage, they acquire a larger form.

The *Radnor Sheep* found in Wales are of two kinds, the *Old Radnor,* and an improved sort, which are now generally termed *the*

Radnor. The former possess some of the characteristics of the soft-woolled variety, but resemble still more the higher-mountain breed, but of a larger size and better form than either, fattening to eight or nine pounds the quarter. The latter sort have been crossed with the Shropshire and other breeds.

The Sheep of Ireland, like those of England, have two distinct divisions—those of the mountain, and those of the vale—but the subdivisions are by no means so numerous as we find in this country. The vale sheep are large long-woolled animals, resembling those which were spread through the midland counties of England before the extensive improvements by means of the Dishley breed were effected. Even in Ireland they are not found pure, having been improved by crossing, though there still remains much room for amendment. There are various breeds of mountain sheep, the principal of which are the *Wicklow* and the *Kerry*. The Wicklow, the more valuable though less numerous, are mostly confined to the Wicklow mountains on the east coast of Ireland, an elevated locality, but possessing a humid atmosphere.

These sheep resemble in many respects those of the Welsh mountains; they are wild little animals, without horns, and with white faces and legs, though there is a tendency to become black, which is shown by the number of black lambs that are dropped. They are larger towards the base of the mountains, where the pasturage is better, and the wool is tolerably fine and rather long, though mixed with hair. Towards the summit of the mountains, the ground being boggy and the pasturage scanty, the sheep are smaller; the wool is less fine and more mixed with hair, which appears in ridges along the spine and neck, thus causing the rain to shoot off the back; and this provision against the evils of their position is still further secured by the lambs having a sort of hairy covering on those parts which come in contact with the damp ground.

The proximity of Dublin occasions a great demand for early lambs, and these sheep are made available for this purpose to a great extent. The mountain sheep are purchased by the farmers of lower and better situations, and the rams being put to the ewes in June, the lambs are dropped about December. They are generally brought up in pens, being separated from the dams in the course of a fortnight, and are forced by sucking those ewes whose lambs have died or have been killed, as well as their own dams. To this is afterwards added cow's milk, so that they are fit for the market in the course of six weeks. The disposition to take the ram so early, the quality of the mutton, and the fact of the ewes being very good nurses, stamp intrinsic value on this

breed, and it is to be regretted that it has not been improved by judicious selection. The breed is preserved pure only in a few places; the improvements must have been by means of the South Down, which has produced certainly a superior race, though there is danger of some of the intrinsic quality of the aborigines being lost by the mixture.

The *Kerry Breed* may be regarded as the type of the various mountain breeds which are found principally in the West of Ireland. Somewhat larger than the sheep of the Wicklow and the Welsh mountains, they are nevertheless though a hardy, yet an unthrifty, race, feeding slowly, and arriving slowly at maturity. Their fat, when accumulated, is found on the inside, and they never exhibit externally any rotundity of shape. They have coarse hairy wool on the back and haunches, but it is soft and fine on the ribs. They have small crooked horns, which are sometimes wanting in the female. Their habits restless and active, they resemble, in their general appearance, the antelope races; and they pick up their subsistence amidst the bogs and peats, occasionally stealing provender from the neighbouring farms. The only good quality they possess is the excellence of the mutton.

THE FOREST AND MOUNTAIN BREEDS.

The Exmoor and the Dartmoor Sheep are the principal forest breeds in the West of England. Located in the higher situations of Devonshire and Cornwall, they are a hardy race, adapted to the poverty of pasture which the forests of Dartmoor and Exmoor afford. The Dartmoor sheep are very small, having soft wool, and white faces and legs; they thrive slowly, averaging when fat, about ten pounds a quarter. Though bred on the heath, they are fattened in the plains, and their mutton is highly praised for its excellence, and commands a ready sale, both in the neighbouring and distant markets. They are wild and restless, and apt to break their pastures when removed to the more enclosed country.

The *Exmoor* sheep are rather smaller than the Dartmoor, and the males have a slight beard under the chin somewhat like goats, and much resemble these animals in their habits and activity and boldness. In other respects they resemble the Dartmoor. Both breeds take the ram early, and when the ewes are put to the Leicester ram, the lambs grow rapidly to a large size. The cross with the Leicester has indeed been found to succeed better than with the Down, but the latter as pure sheep has advantageously supplanted the aborigines in many places, though in the most

exposed situations the change has altogther failed from the Downs not being sufficiently hardy. The Exmoor sheep, in the hands of Mr. Merson and others, have been vastly improved, and no mountain sheep hold their own so well at the Smithfield and other fat cattle shows.

The Black-faced Heath Sheep.—This is a very peculiar breed, habiting the lofty but barren and heathy hills which extend from Derbyshire on the south to the confines of Scotland, through the countries of Cumberland, Lancashire, Westmoreland, and Yorkshire.

Thus situated, this tract of land is much exposed to the winds on either side, and this, with the poverty of the soil, permits only a hardy race of animals to thrive. Though this is its native locality, the breed has however considerably extended itself through the Highlands and mountains of Scotland, penetrating even to the Orkney and Zetland Islands, where to a certain extent it has displaced the original and more inferior breeds.

'This breed of sheep,' observes Professor Low, 'possesses characters which distinguish it from any other in the British Islands. It is of the smaller races of sheep with respect to the weight at which it arrives, but is larger and more robust than the Zetland, the Welsh, and the ancient soft-woolled sheep which it displaced. It somewhat resembles the Wallachian, and as the latter has an affinity with the Persian, it might be conjectured that it is derived from the East; but it is more natural to assume that its peculiar characters have been communicated to it by the effects of food and climate in the rough and heathy district from which it is derived. The male and the female have horns, very large and spirally twisted in the male, but sometimes disappearing in the female. The limbs are lengthy and muscular, and the general form is robust; but the shoulders are not so low as in the Welsh breed, nor are the posterior limbs so long. The face and legs are black, and there is a tendency to this colour in the fleece; but there is no tendency to the brown or russet colour, which distinguishes the older fine-woolled races. The fur is shaggy, and the wool coarse, in which respect it differs from that of all the other mountain breeds of the country. It is of medium length, and weighs about three pounds the fleece, when washed. These sheep are very hardy, and capable of subsisting on the coarsest heaths. They do not, however, like the sheep of Wales, prefer the summits of mountains, but feed wherever pasturage can be obtained; and they are not so nice in the choice of herbage as the South Downs, Merinos, and other races derived from countries yielding the finer grasses. Although wild and independent in

their habits, they are not so restless as the mountain sheep of Wales and other parts, but can be induced to remain in inclosures when sufficient food is supplied to them. The ordinary weight of the wethers, when killed at the age of about four years, is fifteen pounds the quarter, but individuals are made to exceed this weight when properly treated and sufficiently fed from an early age. The mutton is not so delicate as that of the sheep of Wales or the South Downs of England, but it is more juicy, has more of the venison flavour, and is preferred to every other by those

THE BLACK-FACED HEATH SHEEP.

who are used to it. It is the mutton which is principally consumed in all the larger towns of Scotland, and great numbers of the sheep, at the age of three years and upwards, are carried to the pastures of the south to be fattened for the English markets.' An important property of this breed is its adaptation to a country of heaths, in which respect it excels every other. It is this property, as much as its hardiness, that has rendered it so suitable to the heathy mountains, where it is acclimated, and where it finds subsistence beyond the ordinary range of other sheep. It feeds on the loftiest mountains, up to the very verge where the heaths

give place to the musca and other plants of the higher latitudes. Feeding much on the shoots of heaths, these sheep find subsistence in the times of snow and severe frosts better than any other in this country. The mothers are hardy nurses, and are able to bring up their young when they themselves have been exposed to severe privations. A great defect of this breed is the character of the fleece, which, besides being thin on the body, yields wool fit only for the manufacture of carpets and the coarser stuffs. Little general attention has been paid to the quality of the fleece, although it is susceptible of considerable improvement. A defect of the wool, very common in this breed, is the existence of what are termed kemps. These consists of hard and wiry filaments, mixed with the pile. They are deficient in the felting property, and in the oily secretion which moistens the true wool. The removal of kemps is effected by superior food, and by breeding from parents free from the defect. Sometimes individuals of this breed are born with wool, which is fine and short. Were advantage taken of this occurrence, it might be possible by means of breeding to produce a variety with fine in place of coarse wool.

In some places this breed has degenerated from neglect and insufficient food. The sheep of Tweeddale are considered the best; and those of the border counties are superior to the other counties of England. They are rarely fattened on their native pastures, but often pass through several hands ere they reach their final destination, and are often fattened on artificial food. By means of steam navigation, much of the mutton is sent to the metropolis, where its peculiar flavour creates a demand. They are killed for the most part when three or four years old. The ewes receive the rams about the latter part of November, so that the lambs are not dropped till the season is open and mild, an essential point in their exposed and bleak situation, where it not unfrequently happens that many are overwhelmed and destroyed by the severe falls of snow. A little coarse hay is the only additional food these hardy sheep receive, and this is supplied only in sparing quantities, when the frost or snow altogether precludes the possibility of getting any grass. The result of this is that the ewes are often very weak and poor in the lambing season, and yet, being excellent nurses, they support their lambs well. The lambs are weaned in about three months by being simply removed to another part of the farm, and the ewes are found to do best if they are not milked afterwards. In some farms it is customary to dispose of all the young sheep while still hogs, except those wanted to supply the place of the old ewes. In other farms they are kept till two or three years old, and in these latter cases there cannot

of course be kept so many breeding ewes as in the former. One shepherd has usually about twenty-five score of ewes under his care. The flock are sheared in July, and a few days previously are made to swim across a stream, which is all the washing they receive.

The practice of smearing the sheep in November with tar and butter boiled together, in the proportions of eight pounds of the former to six of the latter, is generally pursued, and the benefits are considered to outweigh the loss in the quality of the wool.

'This breed,' observes Professor Low, 'does not appear to amalgamate well with other races, so that crossing has not generally been successful as a means of permanent improvement. It has been frequently crossed by the Cheviot, but the descendants have been found inferior in weight, form, and quality of wool to the pure Cheviots, and to the Black-faced Heath breed in hardiness and aptitude to thrive in an upland country of heaths. But as it is not always deemed safe to change a stock of sheep habituated to their locality, the practice of a continued crossing with the Cheviot until the flock has acquired the characters of the latter has been sometimes adopted, so that the original black-faced stock has become in time almost Cheviot.' Another species of crossing has been remarkably successful, namely, the employing of males of the Leicester or South Down for a first cross. The lambs, the result of this mixture, are excellent, rising to a much greater weight than those of the pure black-faced blood. Great numbers of this mixed race are now produced, and an increased source of profit is thus opened to breeders by the sale of their young sheep. Of these crosses, the best has been found to be with the Leicesters. That with the South Downs produces very handsome sheep, having perfectly black faces and legs, and a close good fleece; but they scarcely attain the size of the Leicester crosses, and the latter accordingly are preferred for the special purpose for which this species of breeding is designed.*

* Mr. Henry Stephens, in his excellent work, 'The Book of the Farm,' thus gives the respective terms used for sheep, chiefly in Scotland :—

'When newborn it is called a "lamb;" if male, in Scotland, a "tup-lamb." When castrated, it is called a "hog-lamb;" if female, a "ewe-lamb." In England a young sheep retains the name of a "lamb" till it is eight months old. In Scotland, after the weaning and before first-clipping, a "tup-lamb" is called a "tup-hog." In England, lambs, after they are eight months, are called, till the first-shearing, "ewe" and "wether-tegs," according to sex. In Scotland, a "ewe-hog," after the first clipping, is called a "gimmer;" a "tup-hog," a "shearling-tup;" and a "wether-hog," a "dinmont." The animal corresponding to the name of "gimmer" in Scotland, is called in England a "theave," until it bears the first lamb,

The Cheviot Sheep is a valuable breed, which has not only maintained its way, but has greatly extended itself. It is a native, as its name implies, of the Cheviot Mountains, which extend from Northumberland into Scotland. Though in many places bordering on the heathy localities of the black-faced breed, and equally lofty in situation, yet the pasturage is altogether different, abounding with fern and wild thyme as well as grasses, and is locally denominated trap. These mountains reach to 2,658 feet above the level of the sea, and are thus exposed to the severe effects of the weather, and remain covered with snow long after it has disappeared from the cultivated plains below. This breed has greatly extended itself throughout the mountains of Scotland, and in many instances has supplanted the black-faced sheep; but the change, though in many cases advantageous, has in some instances been otherwise, the latter being somewhat hardier, and more capable of subsisting on heathy pasturage. They are, however, a hardy race, well suited for their native pastures, bearing with comparative impunity the storms of winter, and thriving well on poor keep. Though less hardy than the black-faced sheep of Scotland, they are more profitable as respects their feeding, making more flesh on an equal quantity of food, and making it quicker. They have white faces and legs, open countenances, lively eyes, without horns; the ears are large and somewhat singular, and there is much space between the ears and eyes; the carcass is long; the back straight; the shoulders rather light; the ribs circular; and the quarters good. The legs are small in the bone and covered with wool, as well as all the body, with the exception of the face. The Cheviot wether

after which it is termed a "ewe of four teeth;" the year after, a "ewe of six teeth;" and after that, a "full-mouthed ewe." The "dinmont," in Scotland, answers in England to the title of "shear-hogs" till they are deprived of the fleece, after which they are called "two-shear wethers," and afterwards "wethers." In Scotland the second shearing brings about another change of names; thus, the "gimmer," if she is in lamb, is called a "ewe;" if barren, a "barren gimmer;" and an "eild-gimmer," if she is not put to "tup" or "ram." A "shearling tup" is changed to a "two-shear tup," a "dinmont" becomes a "wether." When three times shorn, a "ewe" is called a "twinter-ewe," a "tup" a "three-shear tup;" a "wether" undergoes no change of name, but still continues to be called by that name. After the fourth shearing, a "ewe" is a "three-winter ewe," or an "aged ewe," a "tup" is known as an "aged tup." When a "ewe" fails to be with lamb a second time, she is called a "tup-ewe," or "barren ewe;" when she ceases to give milk, a "yeld-ewe;" when removed from the breeding-flock, at whatever age, she is called a "draft-ewe;" when put aside, unfit for breeding, a "gimmer" is called a "draft-gimmer;" and when drafted out of the fat or young stock, lambs, dinmonts, or wethers, are called "sheddings," "tails," or "drafts."'

is fit for the butcher at three years old, and averages from twelve to eighteen pounds per quarter; the mutton being of a good quality, though inferior to the South Down, and of less flavour than the black-faced. This breed has been cultivated and improved with much judgment, as it is capable of being under proper care, but considerable difference is perceived both in the size and qualifications of those sheep kept at the base of the mountains and allowed artificial food, and those located towards the mountains' summits. The Cheviot, though a mountain breed,

THE CHEVIOT SHEEP.

is quiet and docile, and easily managed. The wool is fine, closely covers the body, assisting much in preserving it from the effects of wet and cold; the fleece averaging about three and a half pounds. Formerly the wool was extensively employed in making cloths, but having given place to the finer Saxony wool, it has sunk in price, and been confined to combing purposes. It has thus become altogether a secondary consideration, and though increased in quantity, it is less fine than it formerly was, though where the herbage is short and sweet it is much finer than in coarse and heathy pastures. This breed has extended itself into Wales and

the West of England, and may be justly considered as the best mountain breed existing in this country, and is worthy of introduction in numerous districts now occupied by inferior animals.

The food of the Cheviot sheep consists throughout the greater part of the year of the herbage of their native hills, hay being only allowed when the ground is covered with snow or bound with frost. Occasionally turnips are supplied, but it is rarely that the farm will admit their production. The breeding farms are for the most part in lofty situations, and the sheep are disposed of to the farmers in lower and more cultivated places, in order to be fatted, and sometimes the sheep pass into the hands of several graziers before this is effected. The breeder sometimes sells them the first, but more frequently in the second year, either as hoggets or shearlings, and the wethers are usually fatted in the third year after the second shearing, whilst the ewes are generally kept till they have borne lambs for three years, by which time they are five years old. The period of lambing is necessarily late, in order that there should be a good supply of food; it therefore does not commence till April, the ram having been admitted, at the rate of one to fifty ewes, the latter part of November. During the lambing season greater attention is paid, and the best food supplied. Though twins are frequently produced, it is rarely that the number of lambs reared equals the number of ewes.

'The time of shearing,' observes Mr. Low, 'is from the middle of June to the beginning of July. The precise period is denoted by the wool being fully grown, and separating readily from the skin when pulled. The sheep are first to be washed, which is done by men standing in a pool and washing each sheep separately, or more generally, when the flock is large, by causing them to swim two or three times through the water to the opposite bank. After being washed they are kept as much as possible on ground where they can be prevented from rubbing on banks, or otherwise soiling their wool. In two days, if there be no rain, they may be shorn, but it is better to wait seven or eight days, in which case the unctuous secretion, which protects the wool, has again been formed. As soon as each sheep is shorn, it is usually marked with a stamp dipped in boiling tar thickened with pitch. The mark is made on different parts of the body, as the near-shoulder, the far-shoulder, the near-haunch, the far-haunch, so that the different kinds and ages of the sheep may be known at a glance.

'Soon after shearing, the lambs are weaned, which is simply effected by a short separation of them from the dams. The lambs are now, in the language of farmers, hoggets or hogs, under the respective denominations of tup-hogs, wether-hogs, and ewe-

hogs. The tup-hogs intended for use upon the farm or sale, and such of the ewe-hogs as are designed for receiving the male in the following year, are retained. The remainder of the ewe-hogs, and all the wether-hogs, are either now disposed of, or kept throughout the winter and sold in the following year, either, as has been observed, previously to the period of shearing, when they are still hogs, or after having lost their fleece, when they are dinmonts and gimmers. Sometimes they are kept until they have yielded a second fleece. All the old ewes which have borne the required number of lambs are disposed of before winter, and not only such ewes as are old, but such as are of bad form, or which it is wished from any cause to get rid of. The hogs which are retained are treated in the same manner as the breeding-ewes, except that it is common to put them on some grassy and sheltered part of the farm, where they can be best pastured. They receive hay in falls of snow, and, if possible, turnips are supplied to them during the whole winter, which may be done at the rate of a cartload per day for every seven or eight scores.'

Smearing is less generally practised than with the heath breed, and less than formerly, in consequence of the injury inflicted on the wool from the tar preventing it from being dyed white. Spirits of tar and turpentine, or resin, are sometimes substituted for the tar.

The management of these sheep will admit in many places of much improvement, which can be effected by means of draining and providing more shelter and food in the winter. Vast numbers of them have sometimes been overwhelmed by the snow-storms, which, in these lofty exposed situations descend with merciless severity. Many years ago, as tradition reports, in one winter alone nine-tenths of the Cheviot sheep were entirely destroyed by the storms. A graphic and interesting description is given by Hogg, the celebrated Ettrick Shepherd, of the snow-storm of 1794, in which seventeen shepherds lost their lives, and sheep were destroyed by thousands; one thousand eight hundred bodies being found on the beds of Esk alone after the flood. The difficulties encountered and surmounted by our celebrated shepherd are described with the greatest interest, and the disastrous effects of such storms are strikingly portrayed; and though they occur but seldom, yet the losses are often very severe from ordinary bad seasons, and point out the great necessity of additional shelter.

'The Cheviot breed,' says Mr. Low, 'amalgamates with the Leicester, and a system of breeding has been extensively introduced for producing the first cross of this descent. The rams employed are of the pure Leicester breed, and the progeny is

superior in size, weight of wool, and tendency to fatten, to the native Cheviot. The lambs of this descent are sometimes disposed of to the butcher, and sometimes fed until they are shearlings, when they can be rendered as fat as the parent Leicester, and not much inferior in weight; and further, they can be raised to maturity under less favourable conditions of soil and herbage than the Leicester. The benefit, however, may be said to end with the first cross, and the progeny of this mixed descent is greatly inferior to the pure Leicester in form and fattening properties, and to the pure Cheviot in hardiness of constitution. The system is attended with considerable profit in many cases; the danger is that it may insensibly produce a mixture of the Leicester blood on the breeding-farms. Even this may answer peculiar situations; but there cannot be a question that, for general cultivation in the high and tempestuous countries to which the Cheviot breed is adapted, the race should be preserved in its native purity. Every mixture of stranger blood has been found to lessen that hardiness which is the distinguishing character of the race. The South Downs would seem to be, of all others, that which is best adapted to improve the Cheviot, and yet the experiments that have hitherto been made have shown that the mixed progeny is far inferior to the native Cheviot in its adaptation to a country of cold and humid mountains.'

This cross, however, has been tried in various situations, and amongst others in the Isle of Wight, where, at the Christmas cattle-show (1843), a prize was awarded to a cross between the Down and the Cheviot as the best fat wethers. We are, however, in spite of this favourable testimony, disposed to doubt the advantage of crossing the Sussex Down in a climate so favourable and mild, where we should imagine the pure Downs would be well adapted and much preferable.

Herdwicks.—This breed is confined to the mountain districts of Cumberland and Westmoreland, where it enjoys the reputation of being a hardy and profitable animal, well adapted for the rough and bleak country in which it is kept. The sheep are without horns, and have generally speckled or mottled faces and legs, which become gradually greyish or white as the age of the animal increases. The fleece weighs about three or four pounds. The wool is coarse and open. When left on the hill-pasturage the wethers generally remain until they are four or five years old before they are fit for the butcher; they then average from forty to fifty pounds each. The quality of the meat is first-rate. The ewes are good mothers, and produce generally fine, strong lambs. They display great sagacity on the approach of snow-storms in choosing situa-

tions free from the danger of deep drifts. When the storm reaches them they seek the most exposed part of the mountain, which by the violence of the wind is usually swept clear of snow, and here they remain herded together until the storm has passed, taking care to keep up a continual movement, and thus to trample down the snow as it falls. They possess also the peculiar feature for a mountain breed, that they remain attached to a particular spot or locality, and rarely are met with straying far away from it.

The Lonk.—There is another breed of mountain sheep possessing great merit, being the largest of any. They are black-faced, and are called the Lonk, and were thus spoken of at the Worcester Royal Show in 1863:—'Mr. Peel's pen of Lonk shearlings was especially good. If the Lonks be as hardy as they are good, they must be the most valuable sheep for the hills that we have at present. Sheep which at fourteen months will clip ten pounds of wool and are full of mutton must be dangerous rivals for other breeds. The average clip of Mr. Peel's flock this year was six pounds, and sold at 50*s.* the tod, and the breeding ewes and shearling rams ran on the hillside pastures as they liked.'

The Penistone is a breed of sheep found on the borders of Yorkshire, Lancashire, and Derbyshire, on a heathy tract of land about twenty-six miles in length by twenty in breadth, and they are called the Penistone from the market-town of that name where they are sold. They are described by Mr. Low as having wool of a medium length, of a silky appearance, but harsh and wiry, and weighing from four to five pounds the fleece. They have white faces and legs. The rams exceed the size of the ewes and wethers in an unusual degree, a peculiarity which is ascribed to their being taken to the lower country to be reared. The rams alone have horns, which are very large, lying close to the head, and projecting forward. A distinguishing character of this breed is an extreme coarseness of form, and especially of the extremities. The feet are large; the limbs bony; the shoulders heavy; the sides fat; but the most singular characteristic is the length and muscularity of the tail, in which respect the Penistone sheep differ from all others in this country. This enlargement of the tail is merely muscular and bony, and not at all analogous to the growth of fat which takes place in the tails of certain sheep of Eastern countries. The mutton of these sheep is highly valued for its juiciness and flavour.

THE ANCIENT UPLAND BREEDS.

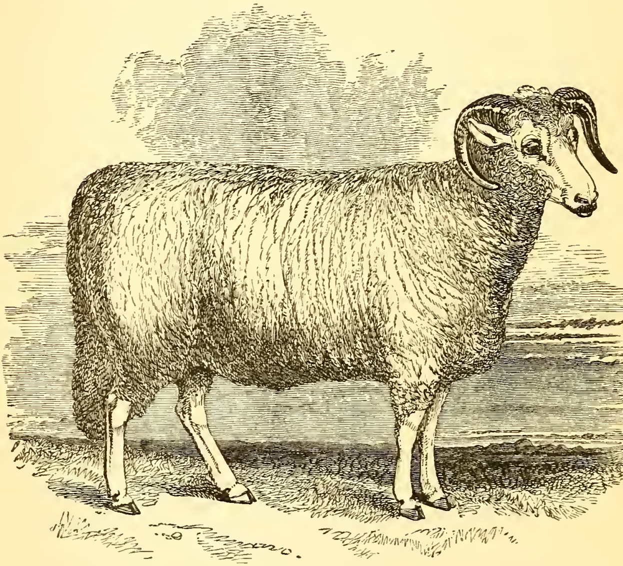
The Old Norfolk Breed of sheep was formerly extensively diffused throughout the high lands of Norfolk, Cambridgeshire, and Suffolk. They are a wild hardy race, somewhat resembling the black-faced heath breed, but differing from them in having longer bodies and finer wool. Their habits are active; their limbs long; and they somewhat resemble the deer. The hind-quarter is good, but the fore-quarter deficient. They have black faces, with horns in both sexes; their wool is adapted for carding, and is used for livery-cloths. They were formerly esteemed as good folding sheep; but with the improvement of tillage they were put in competition with the South Downs, and proved less profitable in every respect, the latter being found to carry a larger fleece, to fatten quicker on the same pasture; and the ewes were more prolific, and better nurses.* In many instances they have been crossed with the Downs, and improved thereby; and in others, they have been altogether supplanted by them, with still greater advantage to the breeder.

They have also been crossed with the Leicester, but though the lambs of the first cross are very fine, they are not found to amalgamate so well with this breed as with the South Down, with which their nature and habits more nearly accord

* The late Lord Leicester, one of the most successful agriculturists this country ever produced, first introduced the South Down into Norfolk in the room of the Old Norfolk. He effected this change, however, slowly and cautiously. On first commencing his agricultural improvements he still preserved the old breed, but, as Lord Spencer informs us, 'When, some time afterwards, he found that the Norfolk sheep were a very unprofitable sort, the same reasons induced him to try the New Leicester breed, a variety of sheep probably as ill calculated to succeed on such a soil as the one he occupied as any breed which he could have selected. He at last found that the best sort of sheep he could adopt were the South Downs. In this, however, as in every other of his farming experiments, Lord Leicester acted with great caution, and did not make the changes till thoroughly convinced by practical experience that they would answer. Accordingly, for several years, he had upon his farm at the same time, Norfolk sheep, New Leicester, and South Downs; he also tried the Merinos, but he did not persevere long with them. I find that so late as the sheep-shearing of 1812, there were still at Holkham both Norfolk and Leicester sheep. Since that time South Downs have been the only sort which he has kept.

'The stock upon this farm, and, still more, the annual exhibitions of the sheep-shearing, proved the great superiority of the South Down over the

The Dorset is a very ancient breed, preserved unmixed from a very remote period, and decidedly the best of all the old horned sheep. Though now found in many parts of Britain in small scattered flocks, they are principally met with in the county after which they are called. They do not, however, extend entirely over the county, but divide it, holding much the smaller half, with the Downs, and are mostly found in the neighbourhood of Dorchester and the western part of the county.



DORSET SHEEP.

This sheep is somewhat larger than the South Down, longer on the legs, with a white face, and legs and horns of moderate size in both sexes. The wool is moderately fine, and somewhat longer than the South Down, averaging about three and a half or four pounds the fleece. The hind-quarter is good, but the fore-quarter somewhat deficient, and the wethers at three years

Norfolk breed of sheep; the latter were abandoned rapidly by the neighbouring farmers, and now, in the whole tract of country between Lynn and Holkham, such an animal as a Norfolk sheep is not to be seen. The Norfolks have been entirely superseded by the South Downs.'

average from eighteen to twenty pounds the quarter, though in some this weight will be greatly exceeded. They are a strong, hard, active sheep, good travellers, and well adapted for folding, though somewhat apt to break their fences, and are by no means so docile as their rivals the South Downs. Although some of their principal breeders contend strongly for their superiority, or at any rate their equality, as regards the general purposes of husbandry, yet public opinion is very justly opposed to these claims. Their principal value consists in their excellence as nurses, great prolificness, and the early period at which they take the ram. They very frequently have twins, and will rear a greater number of lambs than any other description of sheep. They take the ram so early as May and June, and their lambs are usually dropped in October and November, so that they are the principal source of the supply of house and early lamb, which about Christmas and the following month commands a high price. The tails are usually allowed to remain at their full length, and it is common to colour the wool with the red earth called ruddle; and with these distinctive marks they are driven to the Hampshire fairs in the fall of the year, in great numbers, and at Appleshaw, and at Weyhill, one of the largest sheep-fairs in the kingdom, they form a considerable proportion of the sheep offered for sale. It is the ewes in lamb that are thus driven, in the month of October, a distance frequently of fifty or sixty miles, which journey, occupying upwards of a week, they generally bear remarkably well. The wethers are usually slaughtered for local consumption, and a sufficient number of ewes are of course preserved to perpetuate the breed, and these (mostly young ewes) are put to the Dorset ram; whilst the old ewes, or those which it is intended to sell, it is customary to put to the South Down ram, by which means the lambs are free from horns, have dark faces, and thrive faster, and are accordingly greater favourites both with the butcher and the public. It is usual for the farmers living in the counties bordering on the metropolis, as well as those within a reasonable distance of it—as, for instance, Hampshire, and particularly the Isle of Wight—to purchase, at the fairs before mentioned, ewes in lamb, of the Dorset and Somerset breeds, with the view of fatting the lambs first and the ewes afterwards. The earliest lambs slaughtered previous to Christmas are mostly bred up in the house, and with much attention and care. The practice of rearing house-lamb is, however, not so much adopted as it used to be, probably because the demand for it is somewhat fallen off. The system adopted in the districts near London was thus described by Mr. Middleton. Although the

system to a great extent has been discontinued, yet we have given the details in case the practice should be again revived:—

'The ewes are always, without exception, of the Dorsetshire breed, and the early-lambing species are sought for throughout the country with great diligence; for it is thought that not more than one in three will lamb sufficiently early for the purpose. Those of large size with white noses are most in esteem, and anything like black on that part would occasion their being rejected. The colour of the flesh of those lambs when butchered is also a matter which in a great measure governs their value; and therefore those which can be warranted to die *fair* always bear the highest price. Those breeders, with whom the sucklers usually deal, are careful in the selection of rams, the issue of which is said to be known by certain marks in the mouth.

'The rams and ewes should be put together so that the lambs may fall about Michaelmas. The ewes, previous and during the period of suckling, are kept in a croft adjoining the lamb-house, and fed, in addition to after-grass, with turnips, cole, cabbage, or any succulent roots which may be in season, together with brewer's grains, pollard, ground oats or barley, pea-meal, and linseed-cake.

'The lambs are separated from their dams and put into the house, which should be well littered with clean wheat-straw, a little of which should also be placed in racks, with the ears downwards, in order to amuse the lambs, and prevent them from gnawing each other's wool. Some chalk baked in an oven should likewise be put in the troughs, both in lumps and powder, in order to guard them as much as possible against looseness; and the most scrupulous attention should be paid to cleanliness. To ensure quiet, light is excluded until partially admitted when the dams are brought to suckle them, which is three or even four times in the day; but if the house be large enough, the ewes are allowed to remain during the night.

'When the ewe is not capable of supplying so much milk as the lamb will consume, those which have lost their own, or which have been sold early, are brought in and held by the head, or put into a yoke, till the lambs by turns suck them dry; they are then turned into the pasture, and at twelve o'clock the dams are driven into the lamb-house for an hour, in the course of which time each lamb is suckled by its mother. At four o'clock all the dam-ewes —as those which have not lambs of their own are called—are again brought to the lamb-house and held for the lambs to suck; and the mothers are afterwards brought to them for the night. Lambs thus treated will in about eight weeks' time become suffi-

ciently fat, and their flesh extremely white and delicate. The price varies greatly, according to the season of the year when they are ready for the butcher; for they sometimes bring as high as 5*l.* per head, and at others not even half that sum. When many lambs are not suckled, an empty barn is not uncommonly used; but when the house is built for the purpose, if calculated to suckle from 160 to 180 lambs at a time, it should be seventy feet long and eighteen wide, with three coops of different sizes at each end, so constructed as to divide the lambs according to their ages. Deal hurdles are also placed for this purpose about the middle of the house, in order to enable the lambs to find their mothers without difficulty; and it is latticed, in this manner, in order to admit a free circulation of air.

'Grass-lamb, although requiring particular attention as to the season of coupling the ewes, and great care in the feeding, so as to arrive at perfection in time to meet the fall of Easter, at whatever period that may occur, yet does not of course fetch so much at market as house-lamb; but then the trouble and expense of raising it are not nearly so great.'

'One hundred and fifty ewes of the Dorset breed,' says Arthur Young, in his 'Survey of Hertfordshire,' 'are said by the lamb-breeders to produce them 200 lambs of both kinds, on an average of years, exclusively of twins, in this manner:—100 of the old stock, tupped in the month of June, drop their lambs some time before Christmas, so as to have them gradually at market previous to grass-lamb coming into season; then fifty purchased in lamb at Michaelmas produce fifty lambs in the latter end of October, and fifty more in July, all of which are sold within the year.'

It is at the present day, however, very rarely, if ever, the case to raise so large a proportion of lambs from such a number of ewes. Whilst there is less demand for house-lamb there is a greater supply of grass-lamb, and consequently the price of the former is reduced, and will not repay so great an expense as well as trouble as used to be bestowed on the production of this luxury.

The Dorset horned sheep is, however, a much superior animal to the old Wiltshire and Hampshire. Shorter on the legs, with a more compact frame, and a rounder barrel, this sheep, besides its peculiar value for the production of early lamb and its remarkable prolific qualities, is by no means to be despised for its feeding properties. It is not unusual for these sheep, as well as the kindred though somewhat larger Somersets, to be brought into the market in March and April, together with their lambs, and sometimes pairs, all fit for the butcher at the same time.

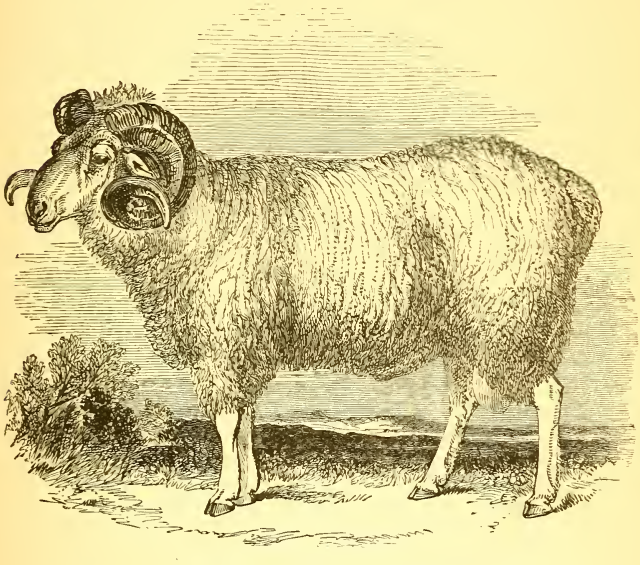
The Dorsetshire and Somersetshire sheep are raised on tolerably good land, where they have been preserved pure and improved by selection. It is usual, however, to put the ewes that are intended to be sold to the South Down ram, which improves the quality and fatting predisposition of the lamb; and the ewes are usually sold at the Hampshire October fairs, by which time they are very forward in lamb. The buyers of the ewes, although the usual custom is to sell off the ewe and lamb the following spring, sometimes keep a portion of the ewes another year, putting them again to a black-faced ram. It is remarkable that these ewes are not only exceedingly prolific and rarely have any mishap in yeaning their lambs, but will carry on all the functions of maternity whilst almost fat themselves. In South Hampshire, which is celebrated for the excellent quality of its early lamb, this system is carried out to perfection, particularly with the Somersetshire ewe. The drawback to this breed of sheep, as compared with the Hampshire and South Down, is the longer period required for their maturity, the richer food required, and the somewhat inferior character both of the mutton and the wool. There is not so much competition in this and competing breeds at the various shows as with many other sheep; still great improvement is noticeable, and both the wool and the carcass have participated in the advance. Mr. H. Mayo, of Frome, near Dorchester, has latterly been one of the most successful exhibitors.

The Somerset Sheep is a variety of the Dorset, possessing the same peculiarities, but differing from it in being larger, and in having pink noses instead of black or white. The wool, too, is somewhat longer and is coloured lighter, and the lambs are larger. In the neighbourhood of Southampton, where many lambs are reared for the London as well as the local markets, preference is generally given to this breed. The observations we have made on the Dorset sheep will in a great measure apply to this variety. They are rarely kept over one year, and at the Botley Easter Show, near Southampton, it is common to see both the ewe and her lamb, and sometimes two lambs, fat and offered for sale at the same time. At this time the lambs reach considerable weight.

The Portland Sheep is a much smaller variety of the Dorset breed, bred on the Island of Portland, which maintains about four thousand. They have horns, white faces, and legs with a tinge of dun. The mutton is excellent and delicate, and commands a good price; and the wethers, when fat and about two years and a half old, weigh from ten to twelve pounds per quarter. The wool is coarser than the Dorset, and the fleece is very light. The sheep are rarely fatted on the sterile soil which produces them, but are

usually purchased by the farmers in the neighbourhood of Weymouth.

The Old Wiltshire Breed.—This race of sheep, now nearly extinct, formerly extended over the greater portion of Wiltshire. Indeed the only place where they were met with some few years



THE OLD WILTSHIRE BREED.

since was on a farm near Hindon, bequeathed on the condition that a flock of this breed should be preserved pure. They are large sheep, horned in both sexes, with large coarse heads, Roman noses, white legs and faces, flat sides, long thick limbs, presenting altogether a most unfavourable specimen of sheep abounding in those qualities which it is necessary to avoid. The wool, however, was fine, though scanty, the belly being destitute of wool, and the fleece weighing only two-and-a-half-pounds. They were very slow in getting fat, and we cannot be surprised that these unprofitable animals should have given place to a superior breed.

The Old Hampshire Sheep, nearly resembling the Wiltshire, may be considered as quite extinct as a pure breed, and are now only subjects of tradition. Some of the blood, however

is still preserved in sheep which occupy most of the northern part of this county, and called the Hampshire Down, and which sprung from crossing the Old Hampshire with the South Down, the latter blood being allowed to predominate greatly.

The Old Berkshire Sheep have shared the same fate as those just mentioned, having been altogether superseded or neutralised by crossing. There were, however, two breeds of sheep in this county, one horned, resembling that just described, and the other polled, but both large unthrifty animals, with fine wool, but with few merits otherwise.

The Hampshire Down Sheep, as it is locally termed, is to be found pretty generally in the northern division of Hampshire, and with a little variation it extends into Berkshire and Wiltshire. The precise origin of this variety it is somewhat difficult to discover, but it may be considered nearly one hundred years old. The original breed of Hampshire was a large long-horned sheep, with tolerably fine and short wool, hardy and a good milker, resembling in many respects the Old Wiltshire preserved in one flock till recently, being unthrifty and coarse in the bone, and particularly about the head. This sheep had probably existed on the downs of Hampshire for ages, and no doubt furnished the principal supply of wool to the manufactory at Winchester established by the Romans, although the Sussex Down might also have assisted.

The Hampshire Down sheep are larger than the South Down, with stouter and coarser bone, and longer on the legs. The rams, particularly, were remarkable for the largeness of the bones of the face and the prominence of the profile. This was considered a good point, and prevails in a lesser degree in their improved offspring. The quantity and quality of the fleece is similar, though rather shorter, and there is more wool about the legs. They are quite as hardy as the Sussex, good travellers, well adapted for folding, and their faces somewhat blacker. Many North Hampshire farmers contend that they can keep quite as many of these larger sheep, and that therefore they are more profitable. This is disputed by others, and we think with good reason; but there is no doubt they gain flesh more rapidly as young sheep, and this is the cause of their rapid extension.

The *Old Berkshire* sheep had a mottled face, that in most other respects resembled the Old Hampshire, with which it was frequently crossed in each county, and mingled, as before noticed, with the Sussex blood.

In our essay on Cross Breeding written for the 'Journal of the Royal Agricultural Society,' vol. xx., we remark :—'History fails

to supply us with the origin of our various breeds of sheep; but we doubt not that, for many centuries after the time of the Romans in this country, certain distinct breeds were perpetuated with little improvement and little change. The progenitors of the present South Down or Sussex breed, inferior as they were to their descendants, ranged probably, in the days of the Romans, over the South Down hills; whilst another breed, now happily extinct, occupied for the most part the hills and downs of Wiltshire and Hampshire. A large, bony, narrow, but active sheep, with large heads, Roman noses, and long curly horns, high in the withers and sharp in the spine, but yet the largest short-woolled breed in existence, were the denizens of these countries during the last century.

'In Wiltshire, although they remained as a pure breed much longer than in Hampshire, yet, as far as can be learnt, they were supplanted by the South Down, whose superior qualities displaced the Old Wiltshire altogether; and we are not aware of any instances in which they were crossed, except for the purpose of crossing them out by using again and again the Sussex ram.

'Mr. James Rawlence, of Bulbridge, near Wilton, whose large practical experience as sheep breeder stamps his authority with considerable weight, observes, in reply to the author's inquiry:—"The last flock of this breed (Old Wiltshire) disappeared about the year 1819, and the substitution of the South Down commenced late in the last century. In many cases South Down ewes as well as rams were brought out of Sussex to replace the horned flocks, but in numerous instances the two breeds of sheep were crossed, and by the continued use of the South Down ram the chief characteristics of the horned breed were merged in the Downs. The cause of the very rapid substitution of the Down for the Old Wiltshire may be found in the fact of the large number of enclosures of common fields which then took place. The sturdy hard wether was thoroughly competent to take care of himself when the system of feeding in common prevailed, but when each farmer could keep his flock separate, an animal of superior quality was preferred."

'In Hampshire, on the other hand, where the same sheep prevailed, and were valued for their hardihood, and their powers of travelling far, and folding hard—properties so valuable when the fertility of the light soils was mainly kept up by these useful manure-carriers—these sheep were extensively crossed. Previous to the close of the last century, the South Down sheep had been greatly improved by careful selection, and the name of the late Mr. Ellman was well known for his eminent services in bringing

out and improving the latent qualities of this valuable breed. About the beginning of the present century the sheep-breeders of North Hampshire began to bestir themselves, and a few enterprising farmers procured some rams from Sussex, of the South Down breed. Finding the experiment successful, it was repeated again and again, care being taken to select the largest, coarsest, and blackest-faced rams which it was thought would suit the coarse sheep with which they had to amalgamate.

'How many crosses with the pure Sussex were used we cannot ascertain, but enough materially to alter the character of the breed, to cause the horns to disappear, and to change the colour of the face from white to black; and, with these changes, to impart a more compact frame, a broader back, rounder barrel, shorter legs, and superior quality altogether, and yet preserving the hardiness and the disposition to make early growth which the original flock no doubt possessed, and with it the large heads and Roman noses which form so distinguished a characteristic of the Hampshire Downs, and which are unquestionably derived from the original breed. Indeed, it is only necessary to inspect a drawing of the original Hampshire or Wiltshire sheep to become thoroughly satisfied as to the source from whence is derived the colossal head which some twenty years since was regarded as, I will not say an ornament, but an indispensable appendage of the breed. Uniformity of colour is also a great point with most Hampshire breeders, with what amount of advantage we cannot say; but black tips to the ears as well as black faces are deemed essential, and any crossing with speckled-faced sheep, such as the Shropshire, is in consequence viewed with dislike. It was not until the Wiltshire sheep-breeders began to produce some large but more symmetrical animals that the Hampshire men began to consider whether it was not possible to reduce the size of the heads, without losing the characteristics of the breed. By attention and careful selection this has been accomplished, and we have now a breed of sheep which is admirably adapted to the present system of fatting off the male part of the flock at much earlier ages than formerly. It is certainly not owing to any aristocratic patronage that the Hampshire sheep have forced their way into public estimation. They have neither been upheld by agricultural societies or agricultural writers, nor have they been launched into public favour as winners of prizes; on the contrary, they have been laughed at, criticised, and condemned; and yet they have not only held their own, but have spread far and near, so that the county in the south or east of England where none are to be found is probably the exception rather than the rule.

'The Hampshire sheep, and the improved Hampshire still more so, may therefore be instanced as an example of successful crossing, and as a proof of what can be done by the male parent, in changing, in very few generations, the character of the original, and yet retaining its good qualities, thus forming a breed more intrinsically valuable than either source from whence it is derived. It has been truly said that the public is wise though composed of fools; and undoubtedly, when the pocket is concerned, the decision of the public is for the most part correct. Thus at the various autumnal fairs large lambs are in the greatest request, and command the highest price, which in itself is a sufficient proof that with a given amount of food they make a greater quantity of mutton.

'It was found indeed by Mr. Lawes, in his elaborate experiments, that the Hampshire sheep, although they were surpassed by the Cotswold, yet exceeded the South Down in the amount of mutton raised from a given weight of food. The greater economy of fatting a young over an old animal may be readily explained by the fact, that whilst the latter increases in fat alone, the former does so both in flesh, fat, and bone, and thus the latter can assimilate a greater amount of the nutritious properties of the food, and is consequently a more profitable feeder.

'We have no reason to suppose that after a few generations the Hampshire breeders continued to use the Sussex rams; as soon as the horns were gone, to which, perhaps, the Berkshire Notts contributed, and the face had become black, they employed their own cross-bred rams with the cross-bred ewes. If, then, we were asked what original blood predominated in the Hampshire sheep, we should unquestionably say the Sussex; but if the further question were put, Is the present breed derived from the Sussex and the original Hampshire alone? we should express a doubt as to such a conclusion, as there is good reason to consider that some improved Cotswold blood has been infused. Some thirty years since a Hampshire farmer, still living (Mr. John Twynam), used the improved Cotswold ram with his Hampshire ewes, and the first cross exhibited a remarkable proof of the preponderating effect of the male. The produce, in size, general appearance, and wool, partook far more of the ram than of the ewe, and it was thought that a most valuable breed had been obtained, which, with the increased size and weight of fleece and disposition to fatten of the Cotswold, would combine the hardiness and folding capabilities of the Hampshire. It was found, however, no easy task to perpetuate such a breed after the first cross—the defects of the one parent or the other would appear and re-appear

in the second and third generation, and it was only by careful weeding that anything like uniformity could be obtained. Mr. Twynam's rams were distributed amongst the Hampshire and Wiltshire flocks for several years, and they have no doubt derived advantage from the cross. The fashion of drafting good sheep, if they have not black faces and ears, tends rather to retard the improvement of the carcass. After some few years a change of farm and other causes led to a discontinuance of the experiment, yet many of the cross-bred rams were sold and let to sheep-breeders both in Hampshire and Wiltshire; and although after dipping once or twice into this breed they then ceased to do so, yet they have continued breeding from descendants of the cross; and thus, in very many of the Hampshire and Wiltshire flocks, there is still some improved Cotswold and consequently Leicester blood. Probably an increase of wool has thus been obtained. Some say that on the borders of Berkshire the Berkshire Nott was also used; and others contend, although without proof, that a dip of the Leicester has been directly infused. Be this as it may, there is no doubt that for some years past the Hampshire sheep have, for the most part, been kept pure.'

It is a curious fact, that whilst the system we have detailed has been followed in Hampshire, a very different plan has been adopted in the neighbouring county of Wiltshire. Here the same large, flat-sided, horned sheep ranged over the Wiltshire Downs. They at length succumbed to the superior qualifications of the Sussex Downs, which gradually displaced them, not by crossing them out so much as by being substituted in their place, and thus the imported Sussex became the West Country Down. At length a larger sheep and particularly a larger lamb was demanded, and then the Wiltshire breeders procured rams from Hampshire, and greatly improved their flocks in size, and secured larger lambs. Beginning with Sussex ewes, they have increased the size of the frame without materially enlarging the heads, and thus a very valuable breed of sheep has been formed, the Wiltshire Down, whose more perfect symmetry frequently enables their owners to wrest the prizes from the Hampshire men, and to cause the latter, by the rivalry thus induced, to improve the symmetry of their sheep by careful selection. The 'Wiltshire Down' breeders, therefore, began with the Sussex ewe, and crossed with the Hampshire ram, whilst the Hampshire breeders used the original horned ewe and the Sussex ram. The latter, therefore, have less of the South Down than the former, and, though of greater size and producing somewhat larger lambs, have less symmetry.

Mr. Rawlence informs the author:—'The original flock from

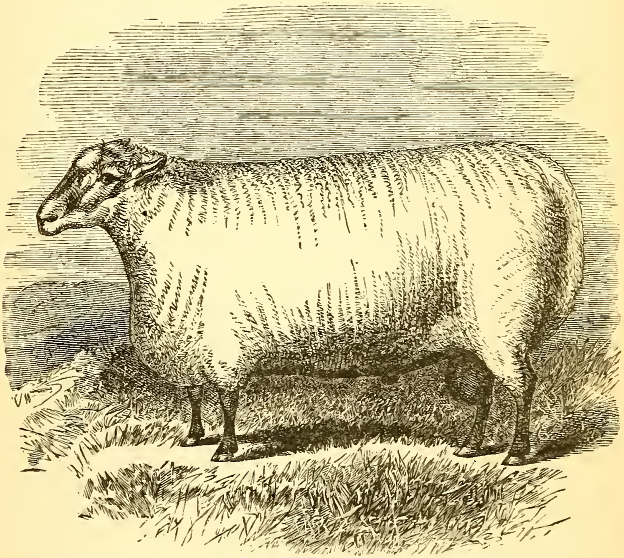
which my present sheep are chiefly descended was of the Sussex breed, and of moderate quality. I commenced by drafting all the small and delicate ewes, and the remainder were crossed with rams of the Hampshire breed. I bred from their produce for two or three years, and then had another cross with the Hampshire. still continuing to cull defective ewes. After I had obtained considerable size from the infusion of the Hampshire blood, I had recourse to some rams bred by Mr. Humphrey, of Chaddleworth,

MR. RAWLENCE'S EWE. IMPROVED HAMPSHIRE.

Berks, which were the produce of the biggest and strongest Hampshire ewes by a sheep of Mr. Jonas Webb's. I use my own rams, and I also frequently purchase a few of the best Hampshire ewes I can get, put my own sheep to them, and use their lambs. I also put a sheep of Mr. Humphrey's to some of the best of my ewes, and select rams from their produce, thus getting fresh blood without making an entire cross.'

Our account of the Hampshire sheep would be by no means complete unless we noticed the breed of the late Mr. William

Humphrey, of Oak Ash, near Wantage, Berks, specimens from whose flocks have frequently been prize-winners, and their services generally acknowledged by other improvers. Mr. Humphrey, in a communication to the author, has furnished the following interesting history of his sheep, which shows that, although they may be correctly designed the Improved Hampshire Down, they are yet *sui generis* and distinct from any others, and may be considered peculiarly his own:—'About twenty-five years since,'



MR. HUMPHREY'S RAM. IMPROVED HAMPSHIRE.

writing in 1858, 'in forming my flock, I purchased the best Hampshire Down ewes I could meet with, using the best rams I could get of the same kind until the Oxford show of the Royal Agricultural Society. On examining the different breeds exhibited there, I found the Cotswolds were beautiful in form and of great size, and I was informed that a Leicester ram was coupled to some of the largest Cotswold ewes, and the most robust of the produce were selected for use. The thought then struck me to obtain a first-rate Sussex Down sheep to put to my Hampshire Down ewes, and so im-

prove the quality and form of my flock, still retaining the size and hardihood so necessary for our low lands and exposed hills. With this object I requested Mr. Jonas Webb to send me one of his best sheep, and he sent me a shearling by his favourite sheep Babraham, which made some good stock out of my large ewes. The next two years I selected for myself, but the stock did not suit my taste so well as the one he sent me, and I did not use them. I then commissioned him to send me his sheep, which obtained the first prize at Liverpool; and from these two sheep, the first and the last, by marking the lambs of each tribe as they fell, then coupling them together at the third and fourth generations, my present stock was made. Not having used any other blood on the male side for more than twenty years, I found some difficulty at first; when putting the first produce ewe, the lambs coming too small to suit my customers. To obviate this difficulty, I drafted out the smallest ewes, replacing them with the largest Hampshire Down ewes I could meet with that suited my fancy, still continuing to use the most masculine and robust of my rams to keep up my size. Some of my friends advised me to use a large coarse sheep to these small ewes to remedy the defect, but the larger ewes seemed to me the better way, and that course I pursued. By using no male animal but of my own blood, the pedigree I am now acquainted with for more than twenty years, and it has succeeded hitherto beyond what I could have expected. My object has been to produce a Down sheep of large size, with good quality of flesh, and possessing sufficient strength and hardiness to retain its condition while exposed in rough and bad weather to consume the root-crops on our cold hills. Independently of the value of the Hampshire or West Country Down in an agricultural point of view for such localities as ours, they produce, when slaughtered, a valuable carcass of mutton, giving the consumer a good proportion of flesh to the fat. A friend, when residing in another county, sent to his butcher for 3 lbs. of mutton. The fat seemed so much out of proportion to the lean, that he had the curiosity to weigh the lean. After carefully cutting it out, he found it to weigh $\frac{3}{4}$ lb., or only one-fourth of the whole. This incident shows the importance in breeding of studying the flesh-producing qualities of a new breed, and also in improving an old one.'

Although in the crossing of sheep for the purpose of the butcher it is generally advisable to use males of a larger breed, provided they possess a disposition to fatten, yet in such cases it is of importance that the pelvis of the female should be wide and capacious, so that no injury should arise in lambing, in con-

sequence of the increased size of the heads of the lambs. The shape of the ram's head should be studied for the same reason. In crossing, however, for the purpose of establishing a new breed, the size of the male must give way to other more important considerations, although it will still be desirable to use a larger female of the breed which we seek to improve. Thus South Downs have vastly improved the larger Hampshires, and the Leicester the huge Lincolns and the Cotswolds.

In Dorsetshire the same system has been pursued as in Wiltshire, although more recently and to a much less extent.

In the eastern part of the county the Wiltshire system of crossing has been followed with still greater latitude. The object being to secure size without coarseness, the rams of the Hampshire as well as the Sussex are each used as the fancy of the breeder may direct. Other breeders in this county adhere firmly to the South Down, which they seek to improve by using first-class rams; and the superior quality of the fleece, as compared with the Hampshire, forms no small part of their motives for so doing. Some years since the South Down sheep in Dorsetshire, it is said, received a cross from the Devon or Bampton Nott, a large long-woolled sheep, but with a good disposition to fatten. The cross was approved of, and the produce were used by other flockmasters, which circumstance has perhaps rendered the Dorsetshire South Downs somewhat larger than the Sussex. There are some eminent breeders of the improved Hampshire in the neighbourhood of Dorchester, as Mr. Saunders of Watercombe, and Mr. Fookes of Cerne, whose annual ram sales show the high estimation in which their sheep are held.

Other Crosses.—We have confined our examples of cross-breeding pretty much to the breeds of our own locality, but it must not be forgotten that other counties have also some noble specimens of cross-bred sheep. Shropshire is celebrated for its breed of sheep, and under the new regulations they compete very successfully at our annual shows. At the Chester meeting they beat the Hampshire Down as old sheep, but in their turn were conquered by the latter in the younger classes. They present themselves to our notice in a more compact form; though shorter, they are wider, broader on the back, and often deeper through the heart.

The South Down or Sussex Breed.—Whilst the Leicesters cannot trace their origin more than ninety years, when they sprung into notoriety, a different animal altogether from their predecessors; the South Down, on the other hand, can trace a long line of pure descent from a period antecedent to William the Con-

queror. It is unquestionably one of the purest and most unmixed breeds in the kingdom, as well as one of the most valuable. It holds a place in the esteem of breeders inferior to no other; and though its different qualities altogether preclude any competition with the Leicester, year after year we find the *élite* of this breed carrying off prizes of equal amount and importance. It ranks with the Leicester, being first among the short-wools, as the latter is amongst the long-wools. It is pleasing to find in each of these breeds the success of different, though equally good, principles. Whilst the Leicester sprang, as it were, from a few individuals possessing the qualifications which the breeder thought desirable, the South Downs have reached their present perfection by the constant and unremitting attention to the purity and perfection of the original breed; added to the fact that the upland downs of Sussex, the native locality of the breed, being though extensive yet narrow, were immediately connected with the farms of which they formed a part, and thus permitted the extensive cultivation of artificial food, which tended greatly to increase the number and improve the quality of the sheep. The improvement of the South Downs has therefore been slower in its progress, but it has been obtained without any sacrifice of the intrinsic qualities of the original breed. We are, however, chiefly indebted to the late Mr. Ellman, of Glynd, in Sussex, as being the earliest and most successful improver of this breed. In 1776 Arthur Young speaks of them as having a fine coat, but at the expense of a thin chine, low fore-end, and rising backbone. The chief principle adopted in improving them has been to amend these evils, and in so doing the improved breed have become smaller in bone, with greater disposition to fatten, an earlier muturity, and a heavier carcass, whilst still retaining their former hardihood and capability of doing well on scanty pasture. This constitutes the perfection of the breed; they can endure the rigour of the weather, and preserve their flesh where a Leicester sheep would succumb; and thus they are so admirably adapted for the Downs, often travelling to and fro a considerable distance every day, and bearing with impunity close folding, to a degree that few other sheep can endure, and are so well suited for the system of agriculture practised on light lands.

The fineness and quality of the fleece was no doubt one of the original recommendations, but this has become long since a secondary consideration, from the lower price realised, and the altered state of the wool market; and yet with the improvement of the breed, the fleece has also improved and become more abundant.

Mr. Ellman thus described an improved sheep:—'The head

small and hornless; the face speckled or grey,* and neither too long nor too short. The lips thin, and the space between the nose and eyes narrow. The under-jaw or chop fine and thin; the ears tolerably wide, and well covered with wool, and the forehead also, and the whole space between the ears well protected by it, as a defence against the fly. The eye full and bright, but not prominent. The orbit of the eye (the eye-cap or bone) not too projecting, that it may not form a fatal obstacle in lambing. The neck of a medium length, thin towards the head, but enlarging towards the shoulders, where it should be broad and high, and straight in its whole course above and below. The breast should be wide, deep, and projecting forwards between the fore-legs, indicating a good constitution, and a disposition to thrive. Corresponding with this the shoulders should be on a level with the back, and not too wide above; they should bow outwards from the top to the breast, indicating a springing rib beneath, and leaving room for it. The ribs coming out horizontally from the spine and extending far backward, and the last rib projecting more than the others; the back flat from the shoulders to the setting on of the tail; the loin broad and flat; the rump long and broad; and the tail set on high and nearly on a level with the spine; the hips wide; the space between them and the last rib on either side as narrow as possible, and the ribs, generally, presenting a circular form like a barrel.

'The belly as straight as the back. The legs neither too long nor too short. The fore-legs straight from the breast to the foot, not bending inward at the knee, and standing far apart both before and behind; the hocks having a direction rather outward, and the twist, or the meeting of the thighs behind, being particularly full; the bones fine, yet having no appearance of weakness, and the legs of a dark colour.

'The belly well defended with wool, and the wool coming down before and behind to the knee and to the hock; the wool short, close, curled, and fine, and free from spiry projecting fibres.'

A favourable specimen of a South Down ram is exhibited in the annexed cut. The original was bred by Mr. Drake, then living at East Tytherby, Hants.

* Though at first a speckled face might have been permitted, yet for many years past it has not been tolerated by eminent breeders, and the late Messrs. Ellman, it is said, could not even endure a spot in the face or ears. Thus it is probable that the colour of the face has become more uniform and of a darker shade in choice flocks, and the term 'brown-grey' may perhaps be a more appropriate description.

Nothing perhaps can better show the sterling qualities of this breed than the facts, that at one time the wool ranked as fine wool, and was generally adopted for carding purposes, and then commanded a high price, whilst now, in consequence of the large supply of superior foreign wool, that of the South Down is no longer considered fine, but is confined principally to combing, and consequently the price is considerably reduced, being less than half what it once realised ; yet, notwithstanding this change, the South Downs have not only maintained their numbers, but considerably

SOUTH DOWN.

increased, and in many districts have altogether supplanted other sheep.

The county in which this breed was first so much improved, viz. Sussex, still retains its pre-eminence in this respect, and most of the modern breeds are founded on Ellman's. The late Mr. Ellman did not exhibit his sheep, but they offered sterling qualities for the careful breeder to resort to with safety. Mr. Grantham, of Lewes, for some years carried off the greatest number of prizes at the Smithfield Show, and he had various breeders around

him but little inferior to himself. He soon had a formidable and frequently successful competitor in the late Mr. Jonas Webb, of Babraham, Cambridgeshire, who possessed a flock of pure South Downs, some wethers from which in the year 1841 carried off the principal prizes at the Smithfield Show, and their qualities were so eminent in relation to the carcass, as to occasion doubts in the mind of an eminent agriculturist whether there was not in them at some period some mixture of the Leicester blood. This suspicion was met, however, by the positive assurance of Mr. Webb that his breed had been always preserved perfectly pure. Mr. Jonas Webb afterwards proved himself by far the most successful breeder of South Downs. He increased the size without losing quality.

We have said that an earlier maturity of this breed has been attained, the wethers being frequently fatted at twenty-two months, sometimes as early as fifteen, and rarely exceeding thirty-two months. At the latter age they have occasionally, though rarely, reached the weight of twenty stone. From eight to twelve stone is usually about the average. They make more fat internally than the Leicester sheep, and thus are greater favourites with the butchers, who usually display their front parts to the street in their shops when hung, whilst the Leicesters are generally turned the contrary way, each being exhibited thereby to the greatest advantage.

The South Down breed has extended itself to all parts of England, Scotland, and Ireland, and where the country is suitable has not failed to give satisfaction—it would indeed be difficult to point out a county that does not possess them. They have to a certain extent supplanted the native breed in Norfolk, Cambridgeshire, and many other counties; and in Hampshire, Wiltshire, and Dorsetshire, their influence has prevailed almost as much by crossing with the native breeds. It is a breed indeed well adapted for hilly pastures wherever the chalk prevails; but it is unable to withstand the severities of the winter in some situations, which the several mountain breeds bear with impunity. It cannot as yet take the place of the black-faced or the Cheviots in the North, or those of the Welsh and Irish Mountains in the West, and it has been tried as a substitute for those of Exmoor, and has been found wanting in the requisite hardihood. The superior quality of the mutton, and the due proportion of lean, render the South Down a greater favourite than the Leicester in the London market, and of late years this preference has been so marked as to induce many breeders to cross Leicesters with the Down rams, and the result of the first cross has been very superior sheep with

dark faces, and partaking of the mingled character of both parents. They have been much more saleable than the pure Leicesters, and possess earlier maturity and superior feeding qualities to the pure Down.

In Hampshire and other places the Down ewe has been crossed with the improved Cotswold ram, and the result has been a much larger sheep, with long wool and good feeding qualities. In some flocks, where the object has been principally to increase the size of the sheep, one cross of the improved Cotswold ram has been employed, then returning to the South Down ram again; and it is astonishing how long the traces of the foreign blood are seen. Some wethers of the fourth cross of this breed were exhibited at the Romsey (Christmas 1843) prize-show, and succeeded in gaining the prize for the bestfat wethers, although there were some splendid pure-bred Downs as competitors. These wethers averaged upwards of 30 lbs. the quarter.

The system of management of the South Down sheep varies with the nature of the farm or district, and the amount or quality of sheep that can be afforded. On the Down farms, both of Sussex and Hampshire, as well as Wiltshire and Dorsetshire, the old system used to be to keep them almost entirely on the Downs throughout the greater part of the year, folding them on the arable land at night, where, during the winter and sometimes most of the year, they were allowed hay. The object in a great measure was confined to breeding, and few attempts at fattening any portion were made; but the cast ewes, lambs, or young sheep, were generally sold off to lowland farmers.

With the introduction of the turnip-husbandry during the last century, the system on these farms has in many respects altered. With an increased quantity of winter food the size of the flocks was enlarged, and the turnips were, as they are still on many farms, devoted to the support of the young sheep, which the farmer was enabled to retain much longer, and likewise permitted him to keep a larger number of ewes. The chief difficulty, however, which arose with this system, and which has not even now been entirely obviated, was the deficiency of food in the spring for the increased size of the flocks. The turnips were to a great extent consumed by Christmas, or soon after; and if allowed to remain during the frosts of January, they often rotted on the ground. Many were the schemes which were attempted to relieve this difficulty; and where there were any pastures sufficiently dry for sheep, the autumnal grass was carefully preserved untouched; and though to a great extent decayed, it yet afforded encouragement

and protection to a new shoot of grass, which was thus, under the denomination of fog-grass, preserved for the sheep when the turnips were gone. The remedy was at best partial, though expensive, and in many farms altogether inapplicable; and it was generally necessary for the farmer to regulate or diminish the size of his flock, according to the prospect of feed which was offered for the spring, to supply which the hay-rick still continued to be the principal resource. These difficulties were, however, to a great extent relieved, though not entirely removed, by the introduction into this country of the Swedish turnip, which valuable root having the property of resisting the influence of the frost, occasioned almost a revolution in husbandry, by supplying wholesome and nutritious food at that season of the year, the latter part of the winter and the early spring, when the greatest difficulty had previously been experienced. The effect of this improvement may readily be conceived: an increased number of sheep were easily kept, and the value of light turnip land became greatly increased, and has ever since continued in demand, for not only is there a greater profit attending the flock itself, but by its means land can be economically manured that would otherwise have received no dressing; and with this addition of valuable manure a very large increase of wheat and barley, and other corn, has followed. Sheep can now be as readily kept and fatted through the winter as the summer; and a remarkable contrast is offered at the present day to that afforded a century or more ago, when it was customary to slaughter vast numbers of sheep, and salt them for the winter's provision. At the present day we know nothing of salt mutton, except as a curious incident in history.

The usual system still adopted on many Down farms in the South of England is to keep the stock-ewes on the Downs, or on what little dry pasture there may be, giving them hay in winter and a few Swedes after they have lambed. They give the bulk of their turnips to their hogs, and they sell off more or less according to the quantity of turnips they may have at their disposal. On other Down farms, where the turnip-husbandry is carried to a greater extent, it is customary to give the breeding-ewes a portion, and where they are judiciously confined to the leavings of the young sheep (which have been exposed to the air and thus partly evaporated, and thereby become much drier than before), the practice is unattended with any injury, and indeed is productive of benefit by keeping the ewes in better condition. On such farms it is often customary to fat off a number of ewes or wethers every year, to the facility of doing which nothing has tended so much as, in addition to the hay or chaff, the giving a portion of

bruised corn or oil-cake, as well as cutting the turnips themselves by a machine. Sheep husbandry is, however, by no means confined to these Down farms, for many farmers keep large breeding flocks without an acre of down and with a very limited quantity of dry pasturage. They make this pasturage extensively available by the assistance of hay and turnips, and indeed some farmers do not scruple to fold their heavy ewes on turnips almost as they would young or fat sheep; but although the practice is often followed with impunity, yet it is by no means to be recommended, as it is often the cause of abortion as well as red-water. It is sometimes the custom, and a good custom too, to divide the flock into three portions—the fat sheep, the hogs, and the breeding-ewes—and so in this order to feed off the turnips. On such farms as those we are now speaking of there is often a greater difficulty in finding sufficient food during the summer than the winter, unless by sacrificing a considerable portion of the anticipated crop of hay. It is here that the great benefit of the broad clover crop—the introduction of which was almost as beneficial to agriculture as that of the Swedish turnip—was experienced, affording as it does an abundant feed even after a crop of hay has been cut, and being often sown with other seeds, and allowed to remain in pasture for two or more years, thus supplying in some measure the want of downs. On light chalky farms sainfoin is also extensively cultivated, and though it produces but one crop of hay in the year, it also affords excellent pasture, and when the land is carefully laid down there will remain a good plant for many years. The aftermath is in high estimation for lambs, and by its stimulating or aromatic qualities counteracts or cures diarrhœa.

Tares or vetches, too, of both the winter and summer variety, are also very extensively employed for the purpose of affording green food for sheep during the summer. The former is sown soon after harvest, and is fit to feed generally about the succeeding June; lasting, however, till the end of July, if sown at intervals of a fortnight, till the end of October. By the time they are consumed the spring tares sown in April and May are fit, and thus a succession of wholesome food is afforded for several months till the clover leys are ready to receive the flock, which is thus kept in an improving state without the assistance of downs or natural pastures. The chief difficulty experienced on these farms, and indeed on most others, and which, in fact, has been a stumbling-block to many excellent farmers, is the inability of procuring sufficient feed in the latter part of the spring, after the Swedish turnips are consumed. To obviate this difficulty many attempts have been made; some resort to fog-grass, before noticed; others feed off the young

wheat, often to the great injury of the crop; but one of the best methods is to sow rye with a little cole-seed immediately after harvest, which may be fed off early in May, and once or twice afterwards, till when Swedish turnips, and particularly mangel-wurzel, may be preserved. The extended growth of mangel and the heavy crops raised have gone far to obviate the difficulties complained of, for the keeping properties of this root are far greater than that of Swedes; and by the time the rye is consumed, the winter tares, if sown early and of an early sort, are ready, and both the tares and the rye may be succeeded by turnips, so that another crop is procured the same year, the land having been manured by the sheep feeding thereon. Another plan occasionally adopted is to sow trefoil and rye-grass (sometimes the latter only) with the corn crop of the previous year, instead of a portion of the broad clover, and thus feeding off this in May, and following it with summer vetches. This plan is recommended as preventing the too frequent repetition of clover. Useful, however, as all these plans unquestionably are, a still better mode of answering the purpose is yet a desideratum. Besides the methods of management which we have noticed, we have also to observe that many farmers keep wether flocks alone, which they buy in the autumn and sell off fat in the following spring, keeping them, of course, on turnips and hay, to which is added corn or oil-cake. On such farms there is generally a deficiency of summer pasturage. On other small farms it is also customary to buy cast ewes in the autumn, and fat them off in the same manner as wethers during the winter.

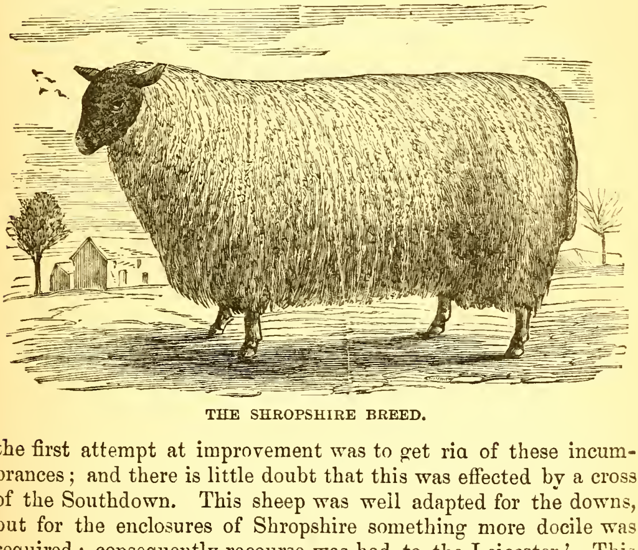
Thus the system of management of South Down sheep is very varied, depending as it does on the nature and quality of the particular farm and the general method adopted in its management. On some farms, too small or otherwise unsuitable for keeping a constant flock, it is customary to take in and keep the sheep of other farmers at so much a-head, the price varying, of course, with the abundance of feed, being sometimes *2d.* to *4d.* per week, and at other times, when feed is very plentiful, it is given for the sake of the manure left behind. Some farmers will put their own heavy ewes in the winter to keep on some park or dry pasture, and take in a wether flock to feed on their own turnips. Sometimes vetches or turnips are thus fed off by the acre, the price being generally moderate, such as 20*s.* to 50*s.* per acre, in consideration of the dung and urine left behind.

Of the various systems of management which we have noticed, that which appears to be adopted by the most eminent and successful sheep-owners is the combined practice of breeding and fattening. By careful and judicious selection in breeding they

possess themselves of the best animals, the qualities of which they are enabled to test when preparing their wethers for the market and the prize shows. It is on such farms the practice of corn and cake feeding is chiefly followed, and which is well worthy the attention of all sheep-owners.

The Shropshire speckle-faced sheep is undoubtedly a cross-bred animal, and indeed affords a striking example of the perfection that can be derived by a judicious mixture of various breeds.

At a late meeting of a Farmers' Club in that county, Mr. J Meire observed :—'It is not attempted to be denied that the Shropshire is a cross-bred sheep. The original breed was horned, and



THE SHROPSHIRE BREED.

the first attempt at improvement was to get ria of these incumbrances; and there is little doubt that this was effected by a cross of the Southdown. This sheep was well adapted for the downs, but for the enclosures of Shropshire something more docile was required; consequently recourse was had to the Leicester.' This crossing and recrossing at length gave place to the practice of careful selection, and thus uniformity was sought for and attained, and the present superior breed was established. It is now held that no further cross is required.

The *Shropshire breed*, which rivals the Southdown and the Hampshire, is unquestionably sprung from a local breed of sheep, called from their native locality the Morfe Common. They were distinguished by the quality of the wool, and is thus spoken of in Professor Wilson's Report of the Breeds of Sheep in the 'Journal of the Royal Agricultural Society,' vol. xvi. :—

'On Morfe Common, near Bridgenorth, which contains about 600,000 acres, there are about 10,000 sheep kept during the summer months, which produce wool of superior quality. They are considered a native breed—are black-faced or brown, or a spotted-faced horned sheep, little subject either to rot or scab—weighing, the wethers from eleven to fourteen pounds and the ewes from nine to eleven pounds per quarter, after being fed with clover and turnips; and clipping nearly two pounds per fleece, exclusive of the breeching, which may be taken at one-seventh or one-eighth part of the whole. The fine wool sells at 2*s.* per pound and the breeching at 1*s.* per pound, making the produce of the fleece about 3*s.* 2*d.* It is sold to Yorkshire."

This appears to have been the original stock from which the present breed of Shropshire Downs has sprung. As the country advanced, and the breeds became valuable for their carcases as well as for their wool, the Morfe Common sheep were crossed with other breeds, but more particularly with the long-woolled Leicesters and Cotswolds or the short-woolled South Downs. The admixture of such different blood has produced a corresponding variation in the character of the present breed of Shropshire Downs, and has tended materially to sustain the hesitation which still exists to allow them a place as a distinct breed.

The Ryeland Sheep has been preserved pure from the most remote period of our history in the county of Hereford, from which it extended itself into the counties of Shropshire, Monmouthshire, Gloucestershire, and Warwickshire, where it received various names, after the localities of the district, such as the Ross breed and the Archenfield, whilst it was termed the Ryeland from some sandy spots used in the production of rye, and in Hereford it is frequently denominated the Hereford breed.

These sheep are of small compact forms, without horns, quiet in their habits, patient, and hardy; the mutton is delicate and juicy, and the carcass from twelve to fifteen pounds per quarter. The wool is white, and extends over the face and forms a tuft on the forehead. They are principally distinguished for the fineness of the wool, which is superior, for carding purposes, to all other of English produce, the Merino alone excepted. This formerly occasioned it to be in great demand, and to realise a good price; but since the general importation of the Merino wool its superiority has caused the demand for the Ryeland to cease, and its price to fall in proportion. Thus the fleece being light, averaging only two pounds, it will not repay the trouble and expense that used to be incurred in keeping these sheep in large cots or houses, containing from one to two hundred, where they were fed with pea-straw and

dry forage—a practice found to conduce very much to the fineness of the fleece, and which was generally practised when the Lemster wool, as it was termed (from the city of Leominster, where it was sold), was in the zenith of its prosperity.

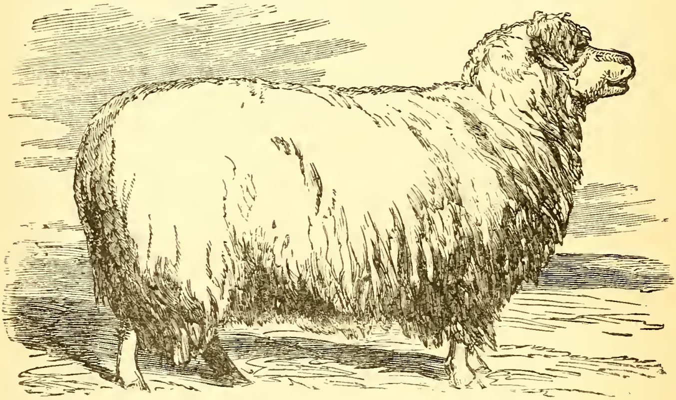
The low price of the wool, the small size of the sheep, and the improvement in agriculture enabling the land to support a much larger animal, have conspired to render this breed less profitable than others, and thus at the present day very few flocks are to be found in a state of purity. This, however, was not done un'il many attempts at improvement had been made. It was thought that an infusion of Spanish blood would greatly improve the fleece, but it was found that the carcass was deteriorated in a still greater degree. Attempts were also made to enlarge the size of the sheep by crossing them with the South Down, the Cotswold, and the Leicester; but though this succeeded to a certain extent, it generally proved more profitable to substitute the new breeds altogether. It was found that this breed was naturally diminutive, and amalgamated less readily than any with other breeds; and a great portion of the land which formerly was comparatively unproductive, and well adapted for the small Ryeland, is now capable of supporting profitably the larger kinds of sheep. The cross with the Leicester has been found most successful, but the quality of the fleece has been altogether changed, thereby becoming long and fit for combing purposes.

THE LONG-WOOLLED BREEDS.

The long-woolled breeds of sheep are properly natives of the rich and marshy pastures of England, from whence, with the improvement of agriculture, they have extended to all parts of Britain, encroaching in many places on the land previously appropriated to short-woolled sheep; so that for years past they have been gradually increasing, while their rivals have decreased or remained the same. The cause of this may be found in the fact that in suitable land they are undoubtedly more profitable than the short-woolled varieties; the much greater weight of the fleece, yielding as much per pound, will account for this, even if the superior aptitude for fattening and earlier maturity of one particular variety were not also in operation. Yet, whilst many of the upland and mountain breeds have been preserved unmixed from time immemorial, most of the ancient long-woolled breeds have either altogether disappeared, or been preserved by the curious in individual flocks; they have either been altogether supplanted by the New Leicester, or in a great measure changed by extensive crossing with this im-

proved breed. Mr. Low makes a distinction of two classes of long-woolled sheep, one belonging to the marshes and fens, and the other to the inland plains. The former includes the *Lincoln* and the *Romney Marsh*; the latter, the *Tees-water*, the *Leicester*, and other varieties.

The Lincoln Sheep.—The fens of Lincolnshire, extending into Norfolk, Cambridgeshire, and the adjoining counties, are well adapted for the support of a heavy breed of sheep, and this accordingly is the native district of the *Old Lincoln*, a breed in its pure state almost extinct; but a flock was long preserved by Mr. Jex,



THE LINCOLN SHEEP.

in Norfolk. They are of a large and coarse form, with flat sides and hollow flanks, and large legs and feet. Their fleece, from ten to twelve pounds and upwards, almost touches the ground, and is long and oily. They fed slowly, but made much internal fat, and were therefore approved of by the butcher. Such was the Old Lincoln, the progenitors of the present race, which have been greatly modified by extensive crossing with the New Leicester, the effect of which has been to diminish the size and the weight of the fleece, but greatly to improve the form, giving a greater aptitude to fatten, an earlier maturity, and a capability of keeping a greater number on the same extent of land. Though for many years this innovation was violently opposed by the admirers of the old race, yet the alteration gradually worked its way in spite of all obstacles, and the mixed breed now presents the largest sheep in Europe. The wethers, when fat have been known to reach the

enormous weight of 60 lbs. per quarter, but the mutton is of course not so delicate as the smaller breeds. Mr. Clarke, of Canwick, in 1827 exhibited two wether sheep in Lincoln market, the fleeces of which had yielded 24 lbs. of wool; and, when slaughtered, one weighed 261 lbs. and the other 250 lbs. The fore-quarters of the former were each 73 lbs., and the hind 67½ lbs. This of course is an extraordinary instance, and considerably above the average, both with regard to the carcass and the wool, the latter of which may be considered to average eight or nine pounds. It is somewhat coarser than the Leicester, but well adapted for worsted goods.

Messrs. Kennedy and Grainger state that the sheep bred in the wolds are deeper crossed with the New Leicester than those on the marsh lands, which may account for the fleece of the latter being heavier. 'The breed of sheep generally,' they observe, 'has been greatly increased since the turnip husbandry has been introduced. Those bred in the wolds, and indeed in every part of the district where this system is pursued, are reared chiefly on artificial grasses. There are, however, great numbers bred on old pastures, the best of which are kept for the purpose of fatting sheep. The usual time for sheep-shearing is about the month of June, the washing taking place ten days previously. No ointment or grease is used after the shearing. The average weight of a fleece from the present sheep is about 7 lbs. (from the true Lincoln it would not be more than 9 lbs.), and the length of the staple from eight to nine inches. The sheep are not kept in flocks, but in separate pastures, and are classed according to their different sorts and the respective qualities of the pastures. They have their first lamb when about two years old, in March or April. Of the returns from a sheep-farm, the fleece is estimated at about one-fourth, or between a third and a fourth; but this depends upon the state of the markets at different periods, the prices both of the wool and the carcass greatly varying; but those considered remunerating are 30*s.* per tod for the wool, and 52*s.* for two-year old wethers, 35*s.* for one-year old do., 27*s.* for ewes, and 21*s.* for lambs.'

'On account of the high price of long or lustre wool,' observes Mr. Coleman at the Central Farmers' Club, 'those breeds that produce that quality demand precedence; for it is not only the price made, but the quantity grown on each sheep, that makes it so worthy of a farmer's attention. The Lincolns are the great wool producers; and I have heard of a flock of sheep, ewes and tegs together, that this year averaged in July 1*l.* per head for their fleeces. The Lincoln requires a good soil, and rather succulent herbage, and is, no doubt, a very fair consumer. Notwithstanding

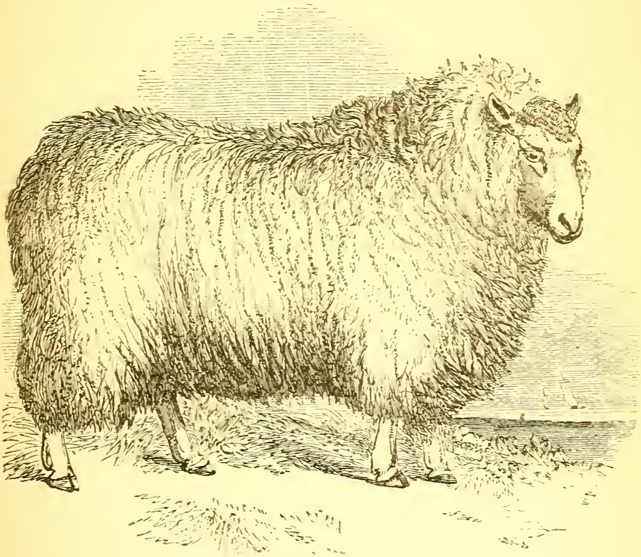
what may be said by breeders to the contrary, I place them at the head of all our breeds of sheep for this quality, as it is preposterous to suppose that a sheep of such large frame, and with such a heavy fleece, requires no more to support it than a small Southdown. Anywhere in the Midland or Northern counties, if our friend happens to be, let him procure sheep with some affinity to the Lincoln—either Lincoln-Leicesters, or Leicester-Lincolns—and there are flocks in this country so convenient that they can supply him with both. I never bred a long-woolled sheep in my life, and am a lover of the Downs; but if I had to start for myself now, and in almost any place in the district I have named, I should go for wool. As we cannot compete with the foreigners in wheat, let us produce that article for which he must be content to be our customer, and leave the fine wools to those who like to grow them. The pure Leicester is fast giving way to the Lincoln cross, and with more wool and less fat will be scarcely distinguishable in a few years from the improved Lincoln.

'In the Eastern counties a short-woolled ewe is kept and crossed by a Lincoln or Cotswold. This is a good practice, as the lambs are fed off at a year old, and the first cross are very fast feeders. In the South and West the Sussex aud Hampshire Downs are the breeds most in favour; and upon their light soils, and from the dry climate, they answer very well; but I know the breeder of such a class of sheep must look with longing eyes to the return made for the wool by the Lincoln men. I find it takes a fair fleece of Southdowns to weigh, as tegs, 6 lbs. per head; this, at 1*s.* 9*d.*, its value last August, gives 10*s.* 6*d.*; but a lot of Lincoln tegs will clip 12 lbs., which, at 2*s.*, its value at the same time, will be worth 24*s.*; and the carcass of the Lincoln sheep shall be worth as much and more, at year old, than the Southdown. However, we cannot all keep long-woolled sheep, but many more of us may with more advantage than at the present day.'

An instance is mentioned by Professor Wilson of the weight of three Lincoln sheep of the respective ages of 3, 2, and 1 year old, as being 386 lbs., 364 lbs., and 284 lbs. This breed of sheep has of late years met with still greater approval in consequence of the quantity and lustre quality of the fleece. Preference is for this reason given to them in our Australian colonies for crossing purposes. Thus in the last year (1873), amongst the largest buyers of improved Lincoln rams, was a gentleman from New Zealand, thus showing how well the breed suits that rising colony.

Romney Marsh Sheep.—Another breed of sheep proper to marsh lands is that which from time immemorial has been found in the extensive fens on the southern coast of Kent, deno-

minated the Romney Marsh. It is nearly on a level with the sea, from which it was reclaimed many centuries ago, and from its encroachment is preserved by means of dykes, similar to much of the land of Holland. It extends fourteen miles in length, and ten in its greatest breadth, and for the most part consists of a rich clay soil, well adapted for the production of a large breed of sheep; and consequently we find they are more numerous than on any other space of land of equal extent, it being not uncommon for seven young sheep and as many fattening wethers to be placed on an acre. The native breed of this district were large coarse



THE ROMNEY MARSH SHEEP.

animals, though somewhat smaller than the Old Lincoln. They had coarse heads and limbs, narrow chests and flat sides, but with large bellies, fatted slowly, not being fit for the butcher till three years old, when the wethers averaged from 35 lbs. to 40 lbs. per quarter, and yielded much internal fat; the fleece averaged from 6 lbs. to 7 lbs. This breed is rarely preserved in a pure state, and then not in the marshes. For the most part they have been extensively crossed with the New Leicester, and have in consequence been greatly improved in form; though the bulk is somewhat reduced, there is an earlie maturity and a greater disposition to

fatten imparted; and though the pure Leicester Ram is now but rarely employed for the purpose, from the fear of inducing a too great delicacy in the breed, and an inability to withstand the exposure to the weather, and the absence of shelter, yet the present race evidently shows the source from whence it derived its improvement. With the improvement effected by the introduction of the Leicester blood there also arose a greater disposition to select the most improved specimens for the perpetuation of the race, and the adoption of this principle has in great measure prevented the necessity of returning to the pure Leicester.

The long-established custom of the Romney breeders has been to send their lambs to the farmers on the uplands, to be kept during the winter; but they are usually kept very hard, principally in the stubbles for a long time, and are often much weakened before they are put into the pastures. They are seldom allowed hay, and this thriftless economy is often very destructive. This want of care is also strongly exhibited in the management of the ewes in the marshes. Shelter is very rarely afforded, however severe the weather may be; but where this moderate expense has been incurred, the cost has been amply repaid, and the lives of many have been saved. If a more general system of shelter were adopted, the breed would doubtless admit of much greater improvement, and would therefore become still more profitable.

The Tees-water.—This is an ancient breed of sheep, called after the Tees, a river separating the counties of Durham and Yorkshire, and running through a fertile valley, from which the breed has extended both to the north and the south.

The *Old Tees-water* was a large tall sheep, of very uncouth form, having a coarse head, rounded haunches, and long and large limbs. The fleece was very long, though rather coarse and thin. These sheep fattened slowly, requiring very good pasture; but they possessed the quality of being very prolific, commonly yielding twins, and supplying them with an abundance of milk. This breed, in its pure state, has become altogether obsolete, having either been entirely supplanted by the New Leicester, or extensively and repeatedly crossed with it.

Other large breeds of sheep formerly existed in the midland counties, but most of them (though quite or nearly as ungainly in form) were of smaller size than the Tees-water. The *Warwickshire* ram is described by Mr. Marshall as having a large loose frame, heavy bone, long thick legs, with great splay feet; his chine, as well as his rump, sharp as a hatchet, and his skin rattling on his ribs. These, and similar breeds, have altogether disappeared in England.

The Bampton Nott.—This is a long-woolled breed of sheep found in the fertile valleys of Devonshire and Somersetshire, and called Bampton from a village of that name, on the borders of the two counties. They had white faces, long and heavy fleeces, coarse forms, thick skins, and weighed from 30 lbs. to 35 lbs. per quarter, at two years old. A smaller variety, having brown faces, crooked legs, and flat sides, were denominated the Southam Notts, and they weighed, at thirty months, 25 lbs. per quarter. The fleece was long and soft, weighing 9 lbs. or 10 lbs. Both these breeds fattened slowly, and were long in coming to maturity; but being extensively, though slowly, crossed with the New Leicester, their defects have in great measure been removed, and they now form a large and valuable breed of sheep; so much so, that a wether slaughtered in 1835 weighed no less than 70 lbs. per quarter.

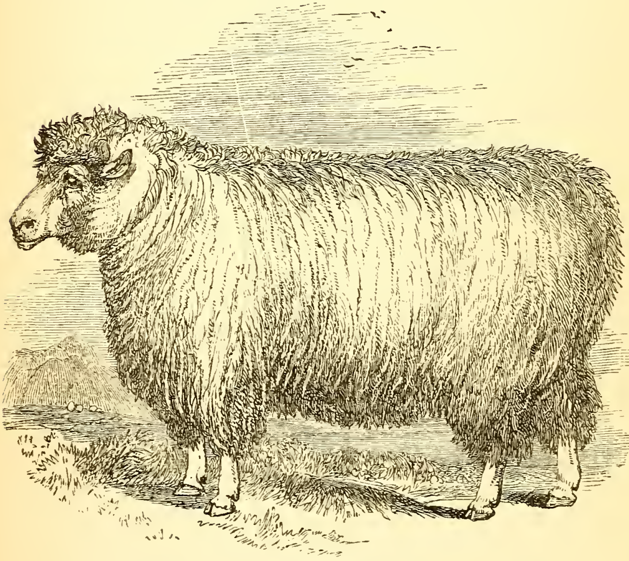
These sheep, under the general designation of Devon Sheep, are met with in the shops of butchers much further east than their native county. They used to supply a considerable proportion of large mutton killed in the southern part of Hampshire, and the wethers frequently average 40 lbs. per quarter.

Devonshire South Hams.—The district in which this breed is met with is somewhat limited, being principally the southern portion of Devonshire, extending from the Vale of Honiton up to the borders of Dartmoor. It has, however, since become a favourite breed in Cornwall. In physical characters they more resembled the Romney Marsh than any other breed, though they differ from them in having brown faces and legs. Latterly, they have been improved by the introduction of Leicester blood; this had the effect of somewhat reducing the size of the sheep, and of causing the colour of their faces and legs gradually to disappear. The points of the animal have been materially improved, a disposition to fatten at an earlier age obtained, and a finer fleece secured. When ready for market, at about two years old, the sheep weigh from 100 to 120 lbs. each. The fleece averages 9 lbs. in weight; the wool is long in the staple, and of moderate quality.

The Long-woolled Sheep of Ireland, though very numerous, and occupying a large extent of level humid country well adapted for their support, were sad ungainly sheep, inferior to the worst of English breeds, being, as Mr. Culley observed, deficient in nearly all the requisites a good sheep should possess. The introduction of the Leicester blood effected, however, a rapid and considerable improvement; and the present, though still capable of much improvement, are greatly superior to their progenitors in every respect.

The Cotswold Breed.—This is an ancient and celebrated

breed, its wool being spoken of very favourably by many old writers. Cotswold signifies a sheep-fold and a naked hill. The Cotswold hills, the native tract of the breed, are of moderate elevation, possess a sweet herbage, and though formerly consisting mostly of bleak wastes, have been latterly much improved. Camden speaks of the breed as having fine and soft wool. Drayton writes of its fleeces as more abundant than those of Sarum and Leominster. Speed, writing two hundred years ago, speaks of the wool as similar to the Ryeland, and rivalling that of Spain. Indeed some imagine it was the origin of the Merino sheep, as in 1464 Edward IV. permitted a number to be exported to Spain,



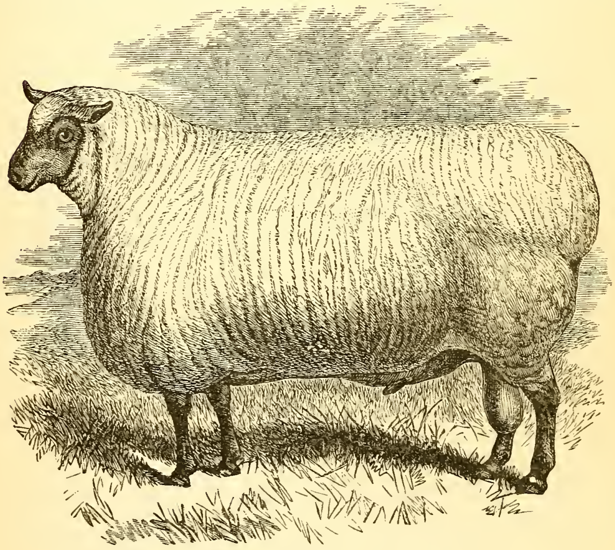
THE COTSWOLD BREED.

where they greatly increased and spread. Spain, however, before this was celebrated for the fineness of its wool. Markham, in the time of Queen Elizabeth, speaks of the Cotswold as having long wool, and Mr. Marshall and other writers consider that they have always been a long-woolled breed. Mr. Low inclines to the opinion that the Cotswold were short-woolled, and supposes that the present race was introducod during the last century. It is difficult to reconcile these differences of opinion; for my own part, I am

disposed to think that the present are the descendants of the old race; be this as it may, we have no evidence, either oral, written, or traditional, of the change having been made. The Cotswold is a large breed of sheep without horns, with a long and abundant fleece, and the ewes are very prolific and good nurses. Formerly they were bred only on the hills, and fatted in the valleys of the Severn and the Thames; but with the enclosure of the Cotswold hills, and the improvement of their cultivation, they have been extensively crossed with the Leicester sheep, by which their size and fleece have been somewhat diminished, but their carcases considerably improved, and their maturity rendered earlier. The wethers are now sometimes fattened at 14 months, when they weigh from 15 lbs. to 24 lbs. per quarter, and at two years old increase to 20 lbs. or 30 lbs. The wool is strong, mellow, and o good colour, though rather coarse, six to eight inches in length, and from 7 lbs. to 8 lbs. the fleece. The superior hardihood of the improved Cotswold over the Leicester, and their adaptation to common treatment, together with the prolific nature of the ewe, and their abundance of milk, have rendered them in many places rivals of the New Leicester, and have obtained for them of late years more attention to their selection and general treatment, under which management still further improvement appears very probable. They have also been used in crossing other breeds, and, as before noticed, have been mixed with the Hampshire Downs.

The New Oxford Breed.—It is under the term New or Improved Oxford that these sheep are so frequently the successful candidates for prizes offered for the best long-woolled sheep at some of the principal agricultural meetings or shows in the kingdom. The quality of the mutton is considered superior to that of the Leicester, the tallow being less abundant, with a larger development of muscle or flesh. We may, therefore, now regard this cross breed as one of established reputation, and extending itself throughout every district of the kingdom. In the neighbourhood of Whitchurch, in the northern extremity of the county of Hants, the system of extensive crossing was commenced about the year 1830 by Mr. Twynham, who was the first to commence a cross which has resolved itself into the New Oxfordshire. His object was at once to hasten the maturity, and improve the carcass and the fleece, and yet preserve the hardihood possessed by the Hampshire Downs. For this purpose he sought for those sheep which possessed these requisites in the greatest degree, and believing them to exist in the New Leicester and the Old Cotswold, he availed himself of the ram produced by this cross, and put it to his

Hampshire Down Ewes; and the produce approximated both to the Cotswold as regards the fleece, and the Leicester with respect to the carcass, and much exceeded the parent ewes in size, but retained their hardihood. He states, in a letter to the author, that the produce was an animal much improved in symmetry, with a fleece nothing deficient in weight from the parent Cotswold, but much firmer and finer in texture, while it retained a great length of staple, say from five to seven inches on the average in the shearlings. Having by this means obtained the animal he wished, he did not pursue crossing any further, but afterwards bred from the same affinity a first cross ewe and a first cross ram, carefully



MR. HOWARD'S OXFORD DOWN RAM.

culling those which were faulty, or exhibited too much of the character of either parent, and studiously aiming at the required mixture of character, which, he observes, may be perhaps properly described as a middle-bred sheep, possessing in combination the qualities of Down and Cotswold. Having first of all selected for uniformity of character, in course of time he turned his attention to procuring a uniformity of colour; and he asserts that under the improved system of farming there is no description of sheep which will pay the feeder so well for consuming the produce of the farm

on the land producing it. They are hardy, make an average of ten or eleven stone (of eight pounds), at fourteen months old, when well fed give at that age eight or nine pounds of wool, of a very saleable description, and, under the future prospect of the wool trade, likely to be more in demand than that from the Downs. And though the flesh, he adds, as old mutton, is inferior to the Downs, yet, at the age above mentioned, it is superior; and having earlier maturity, his sheep will yield the largest return for the food consumed, and are, therefore, the most desirable for the grazier.

The late Mr. S. Druce, of Eynsham, Oxon, was one of the earliest and most successful breeders of the New Oxford Sheep,

MR. HOWARD'S OXFORD DOWN SHEEP.

and he has favoured the author with the following short communication on the subject:—'The foundation of this class of sheep was begun here about the year 1833 (see vol. xiv., p. 211, of the Journal of the R. A. S. E.), by using a well-made and neat Cotswold ram with Hampshire Down ewes. At the same period several breeders of sheep in this neighbourhood also tried the experiment; consequently there has always been an opportunity of getting fresh blood by selecting sheep which suited different flocks,

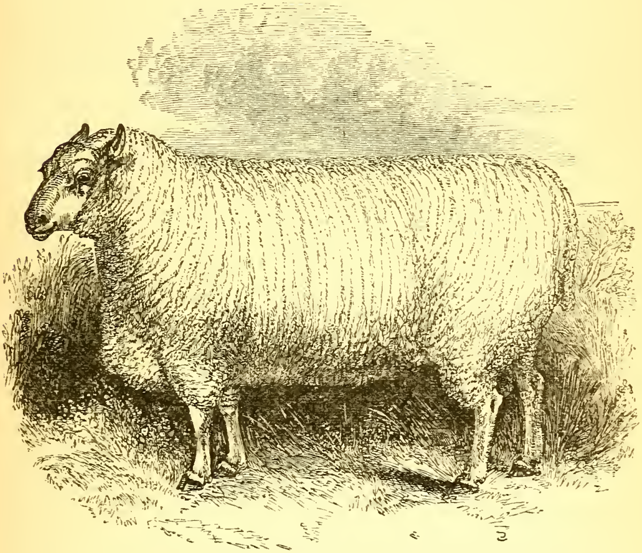
and thereby maintaining the uniform character which is now established. As to the result of this crossing, I could refer you to the names of many breeders who usually exhibit at the Smithfield Club Show.' Mr. Druce adds: 'With ordinary skill in sheep farming, I find no difficulty in keeping the form and size of the animal as it should be, the wool of a valuable quality, and not deficient in quality; and I maintain that the good qualities can be better secured by employing the cross-bred animals on both sides than by confining the practice to the first cross.'

Further experience has completely established the truth of the principle of which Mr. Druce, as well as ourselves, was one of the earliest observers. The law of nature is equally true with other animals as with sheep, and its disregard in the case of horses has almost ruined or extinguished our breeds of useful horses.

Mr. Charles Howard, of Biddenham, Bedford, has also been a very successful breeder of the same class of sheep, following out for some years his own ideas, the success of which has been shown at his ram sales. Mr. Howard commenced with what were then known as half-breds (the produce of Down ewes crossed by a Leicester ram) in 1847, and won a second prize at Smithfield in 1849. In 1851 he hired a ram of Mr. Gillett, who showed at Windsor the first New Oxfordshire sheep exhibited; and thus having a good start, he has kept pretty much to his own blood, although occasionally resorting to another breeder. They have shown their success by taking forty prizes from Bedfordshire Societies, seven from the Royal, and seven from the Smithfield Club. For some seasons Mr. Howard sold his sheep by private contract, but in 1865 he commenced his annual sales, when fifty rams averaged 12*l* each. His subsequent sales have been equally successful.

The Leicester.—The Dishley, or New Leicester, which at the present day has altogether superseded its parent stock so as to be generally denominated '*the* Leicester,' is, perhaps, with reference to its origin, the most artificial breed of any, having been moulded, as it were, by the master-hand of Bakewell, obedient to certain wise principles which he believed to be correct, and which the experience of subsequent years has now fully corroborated. Mr. Bakewell considered that in the productive district in which he resided the carcass of the animal afforded the principal profit to the breeder, and therefore ought to have his principal attention. He therefore banished in great measure other considerations, and applied himself to the selection of sheep, for the purpose of breeding, having in the greatest degree the qualities which he approved; and it is still a matter of doubt

whether he confined his selections to the native breed of his county, or chose them indiscriminately wherever he could find the required qualifications. The old Leicester breed was a large coarse sheep, possessing an abundant fleece, with a fair disposition to fatten. Mr. Bakewell found that by selecting smaller and more compact animals he produced an earlier maturity and a greater disposition to fatten, which more than compensated for the loss



THE NEW LEICESTER SHEEP.

of weight in the fleece and the diminished size; and by systematically and unremittingly carrying out his principles, he at length produced an animal which surpassed all others in the qualities above mentioned; comprising, as Mr. Culley observes, in the same apparent dimensions, greater weight than any other sheep, with an earlier maturity, and a greater propensity to fatten, a diminution in the proportion of offal, and the return of most money for the quantity of food consumed.

The actual sources from whence Mr. Bakewell derived his breed cannot be accurately ascertained. The Old Lincoln, the Tees-water, and the Warwickshire, have each been named; and it has been stated that crosses with the Ryeland, the South Down,

and other short-woolled breeds, have also been employed. It is probable that Mr. Bakewell was not particular as to the source, so that he could obtain the desired qualifications. He himself was very uncommunicative on this point, and the knowledge of the origin of the breed perished with him. It is even unknown whether, and to what extent, he benefited by the previous improvements of others, though it is very reasonable to presume that he did so as much as possible. It is probable, however, that the foundation of his breed was the best existing specimens of the Old Leicester breed. This breed has been still further advanced; some of the evils which crept in with the earlier improvements, such as weakness of constitution, sterility, and inferiority of wool, have been, to a greater or less extent, amended; and at the present day the breed remains the most perfect of any as respects the carcass; and, in the opinion of its advocates, though disputed by others, the best adapted and most profitable for fertile pastures. And while there is no breed of long-wools but what has obtained some improvement from a cross with it, the Leicester, as regards its peculiar qualities, has derived no advantage from a cross with others; but its unrivalled qualifications can only be retained by preserving the breed pure and untainted.

The various points of the Leicester sheep have been thus correctly described :—

'The head should be hornless, long, small, tapering towards the muzzle, and projecting horizontally forwards; the eyes prominent, but with a quiet expression; the ears thin, rather long, and directed backwards; the neck full and broad at its base where it proceeds from the chest, but gradually tapering towards the head, and being particularly fine at the junction of the head and neck; the neck seeming to project straight from the chest, so that there is, with the slightest possible deviation, one continued horizontal line from the rump to the poll; the breast broad and full; the shoulders also broad and round, and no uneven or angular formation where the shoulders join either the neck or the back, particularly no rising of the withers, or hollow behind the situation of these bones; the arm fleshy through its whole extent, and even down to the knee; the bones of the legs small, standing wide apart, no looseness of skin about them, and comparatively bare of wool; the chest and barrel at once deep and round; the ribs forming a considerable arch from the spine, so as in some cases, and especially when the animal is in good condition, to make the apparent width of the chest even greater than the depth; the barrel ribbed well home, no irregularity of line on the back or the belly, but on the sides, the carcass very gradually diminishing in

width towards the rump; the quarters long and full, and, as with the fore-legs, the muscles extending down to the hock; the thighs also wide and full; the legs of a moderate length; the pelt moderately thin, but soft and elastic, and covered with a good quantity of white wool, not so long as in some breeds, but considerably finer.'

The various qualifications here mentioned were not obtained until great and long-continued attention had been paid to the peculiarities of individuals, adapting the ram to the ewe so as to correct the faults or deficiencies either may possess; and thus, by carefully and progressively getting rid of faults, gradually approaching to perfection, which, though it may be rarely or never reached, should yet be the constant aim of the breeder.

It was formerly the custom, as it is still in many places, for the sheep-breeder to set aside the most promising of his pur or tup lambs for the purpose of breeding; and this, with the occasional exchange of animals with other breeders (an exchange probably influenced and guided by caprice rather than by discretion), constituted the only sources of improvement or preservation possessed. Mr. Bakewell introduced a novel plan, which, although at first sight it may appear selfish, yet perhaps has served more to the improvement of stock than any other system yet invented. After he had established his own flock, and had fully tried and proved its superior qualifications, instead of selling his rams, he offered to let them at a certain price; and although the plan was much opposed and discountenanced at first, to his great loss and disappointment, yet it gradually got into use, although the prices he at first obtained were very insignificant, and particularly so compared to what he afterwards attained. The advantages of this plan must be self-evident. It enables the breeder who wishes to improve to do so at a moderate price compared to what it would cost to purchase his rams, and thus in the course of a few years perhaps to become a ram-breeder himself, whilst at the same time the larger remuneration it affords is a proper inducement to the owner of the ram to continue his plans of improvement, whilst it repays him for the outlay of money, and time, and trouble which he has already incurred. The difficulty and opposition the plan first met with, as well as its ultimate success, is well illustrated by contrasting the prices realized at different periods. In the year 1760 the first Dishley Ram was let for sixteen shillings the season, and it was not till twenty years afterwards that Bakewell received anything like a remunerating price. It was then only ten guineas, and it afterwards rapidly increased, till in 1786 he realized three hundred guineas for one ram, and three years afterwards he

obtained no less than six thousand two hundred guineas, thus handsomely repaying and rewarding him for his long-continued and untiring exertions, under difficulties and opposition beneath which most men would have sunk and abandoned their pursuit as hopeless. This system could not be carried on without rapidly extending the improved breed, and of course amending the flocks of breeders to a vast extent, and inducing others to seek a participation in the profits of the system. Accordingly its advocates and promoters formed themselves into a club, denominated the Dishley Society, with the object of extending their breed, preserving it pure, and benefiting and protecting themselves. This society was established by Mr. Bakewell, and the following laws were adopted, the purpose being in the first place to preserve the purity of the breed, and in the second to benefit the members:—

1st. No member shall hire or use a ram not belonging either to Mr. Bakewell or to one of the members of the society.

2nd. No member shall give his rams, at any season of the year, any other food than green vegetables, hay, and straw.

3rd. No member shall let more than thirty rams in one season.

4th. No member shall let a ram for less than ten guineas to any person, nor less than forty guineas to any person who lets rams.

5th. No ram shall be let to serve the flocks of more than two persons,

6th. No member shall let a ram to any one who lets or sells his rams at fairs or markets.

7th. No member shall take in ewes to be served by more than one ram, at his own residence, in any one season, unless they belong to members of the society; nor to be served by any ram he uses for his own flock, with the same exception.

8th. Mr. Bakewell engages not to let any ram for less than fifty guineas to any person residing within one hundred miles from Dishley.

9th. No member shall let a ram to any person residing within thirty miles of Leicester, and not being a member of the society, who shall have hired a ram of Mr. Bakewell during the preceding season.

10th. No member shall sell any ewes or rams of his own breed, to breed from, unless he sells his whole flock of sheep, except to members of the society.

11th. From the 1st to the 8th of June the members shall not show their rams, except to one another. They shall begin their general show on the 8th of June, and continue to show their rams till the 8th of July. From that day until the 8th of September they shall not show them to any one, but shall then open their show again, and continue it until the end of the season.

12th. On the 8th and 9th of June, although the rams may be shown, no ram shall be let or engaged to be let, nor shall the price which will be required for him be mentioned by any one.

13th. Every member refusing or neglecting to abide by the rules of the society, or withdrawing himself from it, shall no longer be considered a member. From that time he shall not be permitted to hire any ram or share of a ram from any of its members until re-admitted into the society at a general meeting.

It was by attention to these rules and the principles adopted by Mr. Bakewell that the Leicester sheep continued to improve, and to be introduced into one county after another, until they are now adopted in every grazing district in England, either as a pure breed or as a cross with others. Their merits are sufficiently tested by the fact that they almost invariably bore away the prizes when competing with other long-woolled sheep at the shows of the Smithfield Club and other Societies. They are unquestionably a more profitable sheep for rich pastures, as regards their feeding qualities, than any other; they come to maturity so much earlier, in this respect excelling even the South Downs, the wethers of the former being fat at twenty-two months, whilst the latter were not equally fat until a twelvemonth older. Since, then, a grazier can fatten two sheep on the same food that one formerly consumed, and in the same period of time, it cannot be doubted that such quick returns must prove the most advantageous system, and a preference will be given to the animal that possesses this earlier maturity. The dead weight of the Leicester sheep is greater in proportion to the live weight than in any other breed the flesh and fat being accumulated more externally, and acquired in the greatest degree in the most profitable places, and the least in the coarse points.

The perfection to which this breed has now been brought is owing to various other breeders besides Mr. Bakewell; amongst whom may be mentioned Mr. Culley, as one of the first and most successful.

The disadvantages of the Leicester are, compared with many other breeds, a certain weakness of constitution, an inability to bear exposure to the weather, and a greater predisposition to inflammatory disease, to which may be added a want of prolificacy in the ewes, and an inferiority as nurses. These points, however, have been much improved since the time of Bakewell, and where the purity of the breed is not an object, they have been altogether avoided by crossing with those breeds excelling in the qualities in which the Leicester is deficient, such particularly as the Cotswold and the Bampton Notts.

The fleece of the Leicester averages about 7½ lbs. in sheep sixteen months old, is soft, but somewhat inferior for combing purposes to that of the older races. The carcase, however, is the principle consideration, and the early maturity is such that the wethers are not unfrequently fattened at fifteen months, and at two years old will often weigh from 25 lbs. to 35 lbs. per quarter. The flesh, too, is accumulated most where it is most valuable, and the fat is distributed for the most part on and amongst the

muscles, and less within the body and around the kidneys than other breeds. The weight of the hind and fore quarters also approximates much nearer than most other breeds.

These various advantages in a great measure counterbalance and indeed outweigh the defects of the breed, and sufficiently account for the facts that in the course of fifty years it had either supplanted or greatly changed nearly every long-woolled breed in the country, that it had in numerous instances caused the substitution of long for short-woolled sheep, and that it had added greatly to the value of the sheep-stock of this country both as regards the wool and the flesh. After producing these changes, intermixing with so many other breeds in so many various degrees, it still, in most respects, maintains its ground; but of late years the opinions of breeders have inclined towards producing a large animal as being attended with more profit, and thus the improved Lincoln and the new Oxfordshire, and some of the heavier kinds, are now successful rivals of the pure Dishley breed. The improved Leicester, however, still commands a large extent of the most fertile districts of England, and is also cultivated in Scotland with equal care and success. It is of course in both countries principally confined to the lowlands or land of pretty good quality; and the following account of the modes of management in Roxburghshire, on the borders of the Teviot and the Tweed, from the 'Journal of the Royal Agricultural Society of England,' vol. i., may be taken as a fair sample of the system adopted in superior districts in either country, and a good example, as regards long-woolled sheep, to less improved localities.

After observing that in the district in question, amounting to about 42,000 acres, prior to the commencement of the present century the Cheviot were almost the only sheep found, whilst at the present time the Dishley breed have with little exception the entire possession of the country, greatly exceeding their predecessors in numbers, but still more in weight, which is no less than double, he goes on to say:—'On nearly all farms of any considerable extent what is called a breeding-stock of these sheep is kept, and the system pursued is generally the following. From the ewes three successions of lambs are taken, the dams being sold off at the close of their third breeding season, or when four-and-a-half years old. In general, the whole produce of these ewes is retained upon the farm on which they are bred, a proportion of the ewe-lambs, when gimmers, coming in to take the place of the old ewes sold in each year. The wedder-lambs, again, are disposed of as fat, many of them immediately after being deprived of the first fleece, and the remainder, after being

fed on turnips, in the winter or spring of the second year. Not unfrequently, however, upon farms where a large proportion of turnips can be raised, the whole wedder-lambs, and sometimes part of the ewe-lambs, are disposed of at weaning-time; and those ewe-lambs kept beyond the number required to maintain the complement of the year are sold when gimmers, generally at about eighteen months old. These young sheep, being thus so early matured for the butcher, are maintained from their earliest time on full feed, it being a great object to prevent them losing any of the condition they generally possess when taken from the ewes. With this view, also, they are early put upon turnips, as it is very desirable they should be well acquainted with this their essential means of support previous to any failure in the nutritious properties of the grass, or the occurrence of severe weather. When either of these events takes place, the turnip forms the chief or only source of their subsistence.

'To the young stock intended to be kept for breeding fewer turnips are commonly allowed, although they are seldom, during any part of the winter, entirely deprived of this useful assistance. The ewes, having at this season the range of the whole pastures, are only allowed auxiliary food during the severity of a storm and in hard winter weather, until towards the approach of the period of lambing, when a proportion of turnips becomes indispensable to maintain them in sufficient condition to bring them well through this critical and interesting season. In general, more sheep are fattened than are bred in the district.

'Exclusive of a considerable number of sheep that are brought into the district to be fed on turnips during the winter months, the number of Leicesters we think we may assume to be maintained now throughout the year cannot be less than 25,600. Of these somewhat more than the half, or 14,500, are disposed of annually, and the quantity of wool produced has been estimated at upwards of 5,100 stone. Under the former system we may conclude that not quite 20,000 smaller sheep were maintained; and, allowing for a proportion being of a better description, it may fairly be estimated there would not be greatly above a third sold in each year, or say 7,000, of such comparative weight as to cause the produce in mutton certainly not to be fairly considered more than a fourth part of the result of the yield of the present time. In wool the deficiency would thus be equal to a half.'

The system here detailed prevails with little difference throughout the midland districts of England, modified, of course, by the fact as to whether pasture or arable land is most abundant on any particular farm. The Leicester ewes, we have said, are but indif-

ferent nurses; their milk is not sufficient to fat their lambs, as in the South Down and most other breeds; consequently the lambs are nearly always kept on till of a more mature age, and many farmers throughout this district purchase Cheviot ewes and put them to the Leicester ram, and the former being good nurses, the lambs are very fine and fatten quickly.

The lambs of the pure Leicester are rarely shorn until the second year, when the fleece often weighs 8 lbs., and is very long in the staple, and, as teg-wool, is more valuable. The ewe fleeces are about 6 lbs., and those of the fat wethers, though shorn in May, average from 7 lbs. to 9 lbs.

The late Mr. Valentine Barford, till his flock was distributed a few years since, possessed a breed of Leicesters preserved pure from the days of Bakewell. They were distinguished by great symmetry; and although he did not go beyond his own flock for his rams, neither the health nor fecundity of the ewes were impaired, but there was this drawback, the sheep were small, and thus although his rams were let annually they did not yield the high prices that larger sheep attained, and were considerably less than the sheep of Sir Tatton Sykes, Mr. Buckley, and others. Mr. Barford prided himself on his sheep being fed on natural food only, and no doubt they were very healthy as well as pure.

The sheep which prevails mostly in the lowlands of Scotland and the good land of the Border Counties are called the Border Leicesters, and the high estimation in which they are held is best shown by the large sums yielded by the rams at the annual lettings. Though not pure Leicesters, they have considerably more of this blood than of any other, and are well adapted for the district.

THE MERINO BREED.

It is doubtful whether this is the proper place to notice a foreign breed, but at one time the Merino sheep bid fair to become naturalised in this country; and although the dampness of the climate and the system of turnip husbandry, together with the practice of folding, is not favourable to the production and maintenance of very fine wool, yet these drawbacks would not have been sufficient to have caused the discontinuance of the breed, which must rather be attributed to the inferiority of the carcass, its slow maturity, and the greater profit to be obtained in this meat-consuming country from other breeds. Like the Romans of old, they came and dwelt in the land, and then left, or ceased to exist as a breed, but not without leaving their mark behind in the improve-

ment of the short-wools of the country both in quantity and quality, for it is pretty well known that where flocks existed they wer gradually crossed out by the continued introduction of other rams. Mr. Darwin states, in his work, *Plants and Animals*, page 88—'How many generations are necessary for one race to absorb another by repeated crosses has often been discussed. Some maintain that a dozen or a score are necessary, but in the tenth generation there will only be 1-1024th part of foreign blood in the offspring. Fleischmann states, in reference to the persistent endurance of a single cross, that the original coarse German sheep have 5,500

MERINO SHEEP.

fibres of wool on a single inch; grades of the third or fourth Merino cross produced about 8,000, the twentieth cross 27,000, whilst the pure Merino had 40,000 to 48,000; so that twenty crosses was not sufficient to make the race pure Merinos.' This example is very suggestive, although no doubt the change is materially influenced by the question as to whether the locality and climate suit the old or the new breed.

Spain, the native country of the Merino sheep, has for many centuries been celebrated for the quality of its wool. During the prosperous ages of Roman dominion its woollen fabrics were the

most eminent in Europe, and also in the later times of Moorish sway were the most celebrated in the world. With the forced departure of the Moors, after a residence of nearly eight centuries, arts and manufactures began to decline; and the progressive effect of bad laws, tyrannical governments, ignorance, superstition, and priestcraft, consummated the fate of one of the richest and most powerful kingdoms in the world. The soil retains its natural productiveness, the sun continues his benignant influence, the hand of Nature is as bountiful as ever, but the perversity of its rulers has marred the whole. Its manufactures are gone, its wealth is consumed, its colonies dissevered; nought remains but the wreck of its former greatness, and those perennial favours which Nature supplies, which man has been unable altogether to destroy. Spain no longer manufactures its woollen fabrics for other countries—it cannot clothe, indeed, its own inhabitants—but preserves its existence by the export of the productions of its soil, of which its fine wool has long been greatly esteemed.

There are various breeds of both long and short-woolled sheep in Spain, but the latter are the more numerous, and amongst them the Merino is the most esteemed. The origin of this breed it is difficult to ascertain. The native breed was probably improved by the importation of the best fine-woolled rams from Italy and Africa, in the period of the Romans, and the improvement in the wool was still further carried on during the time of the Moors. The dry climate and the pasturage is also well adapted for the production of fine wool, and these various causes have conduced to render the Merino sheep the most celebrated for the quality of its wool in the whole world.

The Merino sheep are small in size, with flat sides, narrow chests, and long legs. The wool is usually white, but darker on the legs, face, and ears, and a tuft of coarse wool is found on the forehead; the skin is of a reddish colour, and there is a looseness of the skin under the throat, which is considered favourable, as indicative of a good fleece. The males have large spiral horns, but the females are without any. With these peculiarities it must be evident that, as regards the carcass, the Merino is by no means a profitable animal, and to this must be added that they are bad nurses, so that one hundred ewes will not bring up more than fifty lambs; they are also by no means hardy, and the flesh is inferior. To atone for these bad qualities, the wool is superior to every other kind, and forms indeed the principal source of profit; the fleece is close, short, and abounding in yolk, weighing heavy, and is superior to all others in its felting properties.

It is computed that not less than ten millions, or a moiety of the

whole number of sheep kept in Spain, are migratory, and occupy no less than a quarter of the year in going and returning to their summer and winter pastures. These Transhumantes, as they are termed, leave their winter quarters in the south about the middle of April, and proceed slowly on their six weeks' journey. One division travels towards the east, and the other in a more westerly direction. During their journey they are shorn in large buildings built expressly for the purpose, which are divided into two large compartments, with a smaller one adjoining. Those sheep which are to be sheared first are driven into the small hut as closely as possible, and there remain throughout the night, so as to occasion a considerable sweat, which softens the unctuous matter, and renders the shearing easier. No previous washing is employed, but in this manner a thousand are shorn in a day, there being a sufficient number of shearers in attendance for the purpose. This singular custom, which has existed for centuries, is protected by certain laws, which give to these sheep the right of pasturage on the common lands on their passage, and regulate other matters relating to them. It is stated that there are no less than fifty thousand shepherds employed in tending these sheep, which are generally divided into flocks of a thousand each. These shepherds are a singular race of men, sleeping on the ground whilst on their journey, and living in huts during the rest of the year, and existing on a spare diet, varied occasionally with some mutton from their flocks, which accident or disease may have afforded them.

The sheep remain in their summer quarters till September, when they set out for their return. The rams are put to the ewes in July, so that the lambs are dropped soon after the flock arrives at their winter quarters.

In these long and tiresome journeys it cannot be otherwise than expected that great loss should be experienced from casualties and disease. A great mortality takes place, and many of the lambs are destroyed, in order that the others should have the advantage of a double number of nurses. The migratory system is more ancient than advantageous. It would indeed be far more profitable if the sheep were stationary, and the breed varied so as each kind to be bred on the most suitable pastures.

The stationary sheep are termed Estantes, and consist partly of large sheep and partly of Merinos, besides the mixed breeds, and it is found that the stationary Merinos do better than the migratory ones in every respect.

For many centuries the Merino sheep were confined to Spain, and preserved with jealous care. Sweden appears to have been

the first country which succeeded in procuring them, and in 1723 a small flock was imported from Spain; and there are now about seven hundred thousand in this country, but they are somewhat inferior to the original breed. In France many attempts have been made to cultivate them during the last century, but altogether with but little success. In Germany, however, the experiment has been eminently successful. The Elector of Saxony introduced the first flock in 1765, and about ten years afterwards another small flock was brought to Austria; and in 1786 and 1802 they were introduced to the imperial domains of Holditch in Hungary, and Maunersdorf in Austria. Such is the origin of the German Merino, which has now spread so extensively over these vast countries. There appear to be now two distinct breeds, differing from each other both in appearance and the quality of the wool. First, the Infantado or Negretti, having shorter legs and a stouter body than the others, and the head and neck comparatively short and broad; the nose short and somewhat turned up, and the body round. The wool, observes Mr. Carr, is often matted upon the neck, back, and thighs, and grows upon the head to the eyes, and upon the legs to the very feet. The grease in its fleece is almost pitch, so as to render the washing difficult. This breed is descended from the sheep imported directly from Spain into Austria; whilst the other breed, called Escurial, are those which were first imported into Saxony. They have longer legs, with a long spare neck and head, with very little wool on the latter; and a finer, shorter, and softer character in its fleece, but less in quantity than the other breed. The fleece, in the Escurial, averages from one and a-half to two pounds in the ewes, and two to three pounds in rams and wethers; whilst in the Infantados it is from two and a quarter to three and a quarter in ewes, and from four to six pounds in rams and wethers.

Many attempts have been made to amalgamate these breeds, but without success; the advantages of each can only be retained by preserving them pure.

'These sheep,' observes Mr. Carr, a large sheep-owner in Germany, 'cannot thrive in a damp climate, and it is quite necessary that they should have a wide range of dry and hilly pasture of short and not over-nutritious herbage. If allowed to feed on swampy or marshy ground, even once or twice, in autumn, they are sure to die of liver-complaint in the following spring. If they are permitted to eat wet grass, or exposed frequently to rain, they disappear by hundreds with consumption. In these countries it is found that the higher bred the sheep is, especially the Escurial, the more tender. They are always housed at night, even during

summer, except in the very finest weather, when they are sometimes folded in the distant fallows, but never taken to pasture till the dew is off the grass. In the winter they are kept within doors altogether, and are fed with a small quantity of sound hay, and every variety of straw, which has not suffered from wet, and which is varied at each feed; they pick it over carefully, eating the finer parts, and any corn that may have been left by the threshers. Abundance of good water to drink, and rock-salt in their cribs, are indispensables.'

Baron Geisler was some years since one of the most successful breeders of Merino sheep, and for many years, observes Dr. Bright, 'he has exercised unwearied assiduity by crossing and recrossing, so that by keeping the most accurate registers of the pedigree of each sheep he has been enabled to proceed with a mathematical precision in the regular and progressive improvement of the whole stock. Out of seventeen thousand sheep, comprising his flock, there is not one whose whole family he cannot trace by reference to his books; and he regulates his yearly sales by these registers.' He considers the purity of blood the first requisite towards perfection in the fleece. He adopts pretty nearly the same system mentioned by Mr. Carr, and keeps the young and the old separate from each other; and among his regulations we find the following:—'For fourteen days before the coupling season the rams should be daily fed with oats, and this food should be continued not only during that period but for fourteen days, and one ram will thus be sufficient for eighty ewes, provided great care and attention is paid to him in every other respect during the whole of the season.

'During the lambing period a shepherd should be constantly day and night in the cote, in order that he may place the lamb, as soon as it is cleaned, together with its mother, in a separate pen, which has been before prepared. The ewes which have lambed should, during a week, be driven neither to water nor to pasture; but low troughs of water for this purpose are to be introduced into each partition, in order that they may easily and at all times quench their thirst.

'It is also very useful to put a small quantity of barley-meal into the water, for by this means the quantity of the ewes' milk is much increased. When the lambs are so strong that they can eat, they are to be separated by degrees from their mothers, and fed with the best and finest oats, being suffered at first to go to them only three times a day, early in the morning, at mid-day and in the evening, and so to continue till they can travel to pasture, and fully satisfy themselves.'

Although superior rams are becoming more numerous every year, yet some distinguished rams have, within these few years, realized from one to nearly three hundred pounds. Thus the greatest care is taken, both in the management of the flock, and the selection of males for breeding, so as not only to preserve, but also to improve the quality of the wool. So successful have been these endeavours, particularly in Saxony, that the wool is superior to that of Spain, commands a better price, and, till the rapid improvement of our colonial wool, principally supplied the English market, where it stands unrivalled for the manufacture of the finest cloth. The sheep for the most part are housed during the winter, where they are fed principally on hay, straw, and corn; the improvement of the carcass is altogether a secondary matter, the fleece being the primary consideration. The Merino sheep have been mixed extensively with other breeds, particularly in Prussia and Austria, and in fact this breed has been introduced more or less in every country in Europe.

In England it has likewise received a fair trial, but, from causes which can readily be explained, they have not been profitably cultivated. The first attempt was made by George III., who was a very zealous agriculturist. A flock was first procured clandestinely from Spain, but they were found altogether inferior In 1791 a small but very superior flock was presented to his Majesty, and though at first they suffered much from the rot and the foot-rot, yet the survivors became naturalized to the soil, and remained healthy, and the wool maintained its quality. The breed became fashionable; they were crossed extensively with the South Down, the Wiltshire, the Leicester, and the Ryeland ewes, and for some years the rams were let or sold at high prices. It was thought that by these means the wool of our breeds would be greatly improved, and their other qualities retained; but it was found that, whilst the wool was still greatly inferior to the pure Merino, the other qualities were supposed to have deteriorated. The carcass became inferior, the constitution less hardy, and the experiments so unprofitable that they were almost universally abandoned. The improvement of the wool would by no means compensate for the loss arising from a deficiency in the carcass; for such is the demand for meat of the best quality in this country, and such is the price it accordingly commands, that the flesh must still remain the principal source of profit, and indeed the only one that can meet the heavy expense incurred in using artificial food. As this cannot be retained in connection with the finer description of wool, we must be content with possessing it with wool of an inferior description.

Very few, if any, flocks of Merino are still preserved pure in this country; Mr. Bennett retained for many years a flock in Wiltshire, it is said, in a state of purity, or nearly so; but in most cases they were considerably crossed with other breeds, and in many cases so largely as to cause the principal characteristics of the Merino to disappear. Lord Western still retained a flock of Anglo-Merinos, that is the Merino crossed with the Leicester and the mixed breed, thus produced, afterwards perpetuated. A few years ago it is said that these were very fine sheep, but those exhibited at the Smithfield show in 1843 were very much degenerated.

Although, however, the Merino is found unsuitable for this country, it is not so in our colonies. In the extensive natural pastures of New Holland and Van Dieman's Land, the Merino sheep have been introduced and cultivated with great advantage. The first sheep, however, imported into the colonies were those of a very inferior description from India. But, although these animals were half covered with hair, their fleece improved to a great extent, and they became more prolific, showing the adaptation of the climate and soil for the production of wool, a fact which has been since satisfactorily proved. Soon afterwards sheep from the mother country were imported, principally of the South Down and Leicester breed. They likewise succeeded well, and proved highly serviceable in supplying the infant colony with meat. Being crossed with the Indian sheep, they greatly improved both the fleece and the carcass. At length some Spanish sheep were sent from England, and, being crossed with the existing breed, the fleece so improved as to rival the wool of Spain.* In consequence of this success, Sheep were selected and imported direct from

* Mr. Hood, a writer on Australia, assigns the merit of the introduction of the Merino sheep to Captain M'Arthur, who first went to New South Wales as an officer in the 102nd regiment, in 1791, but retired from the service in 1806, and became a store-keeper in Sydney. Before this, however, he became a breeder of stock, and in 1803 returned to England and presented an address to the then Secretary for the Colonies, Lord Hobart, representing the peculiar fitness of New South Wales for the growth of wool. He took with him some samples of wool from sheep in the colony, originally sent from Holland to the Cape, and taken thence to Port Jackson; these sheep were of the Spanish breed, and the fleece was considered excellent. In 1797 Mr. M. procured three rams from the flocks of George III., at Windsor, and from these and thirty ewes previously purchased in 1793 out of a ship from India, and eight or ten Spanish and Irish sheep, have arisen the million and upwards of sheep that now cover the hills and plains of Australia. This is the part of Mr. M.'s career that is of most interest to the public; by this step he became a benefactor to his country and the colony to an incalculable extent. In 1791 Mr. J. M. got his first grant of land, 100 acres; his second was also 100; next, from Lord Camden, 5,000; and after-

Saxony, and the result was attended with similar success; they were crossed with the native sheep and also preserved pure, and the wool from the latter was found very superior, and commanded a high price in England, though, from the want of that personal attention which the sheep receive in Germany, the wool was not equal to that of Saxony. The greater scarcity of labour in these colonies, and its abundance and consequent cheapness in Saxony, will sufficiently account for this fact.

The cultivation of sheep in Van Diemen's Land was later than in New Holland, but the same course was pursued. The Merinos, however, were first supplied from Sydney in 1820, but were afterwards imported from Saxony. Such has been the success and the increase of sheep in these settlements, that whilst in the year 1810 167 lbs. of wool only were imported into England from New South Wales, in 1832 the quantity brought from both colonies was 3,516,869 lbs., and it still continues to increase, as well as from the other settlements on the coast of New Holland.*

'The attention,' observes Mr. Low, 'of the Australian colonists has been naturally directed to the cultivation of fine wool: but it is evident that there are limits to the profits to be derived from this commodity, both from the increasing production of the country, and from the rivalship of the districts of Europe where the Merino wool is cultivated. It is a question, therefore, whether the colonists should not now direct attention to the long or combing wools as well as to the short or felting. It is probable that the long wools of England would acquire in these favoured climes the very properties which would benefit them the most, and that the heavier fleeces of the Leicester, the Cotswold, and the Old Lincoln sheep, would yield a larger profit to the wool-grower than even the higher priced Merino.† But the two classes of sheep should be kept entirely distinct.

wards 700 acres to his excellent wife from Governor Macquarie. From Earl Bathurst the sons got 5,000 acres, and from Governor Macquarie 2,300; in all, their grants have amounted to 18,000 acres; and they have acquired by purchase 32,000 acres more, at an average cost of 7*s.* 6*d.*, the highest price paid being 18*s.* In all, the landed property obtained by grant and purchase by Mr. J. M. and his sons amounts to 50,000 acres!! Mr. M. never keeps above 25,000 sheep, in consequence of the great expense and difficulty in managing a larger number. He has 700 acres under the plough. Mr. J. M. purchased, in 1800, sixty acres of land in the township of Sydney, for 25*l.*, which, in 1836, were valued, according to the government land price, at 1,000*l.* an acre!

* In 1870 there were upwards of fifty million of sheep in the Australian colonies.

† In New Zealand the production of long lustre wool has been very successful. In the present year (1873) the largest buyers and highest bidders for Lincoln rams have been gentlemen from this colony.

The vicissitudes which the breeding and cultivation of sheep in these colonies have undergone are so striking that although a great change has now taken place, it is useful to preserve a record of past disasters.

'Sheep,' observes Mr. Hood, 'that sold at 16*s.* and 20*s.*, may now (December 1841) be had for 8*s.* and 10*s.*, and cattle have fallen from 5*l.* to 35*s.*; while at sales in Sydney the former fetch 1*s.* 6*d.*, and the latter 30*s.*' Although this certainly offers a very favourable opportunity to the large capitalist for investment, it yet strikingly displays the fluctuations to which the value of such stock is exposed, and which must ever continue until some better method is adopted for supplying water, and obviating the sad losses which so frequently occur from the droughts to which this country is liable. 'It will scarcely be believed in England, observes Mr. Hood, 'that the estimated number of sheep which have died within the last twelvemonth in the colony from catarrh and drought is seventy thousand!! that colonists are compelled, in order to save the dam from starvation, to cut the throat of her lamb; that no means are adopted for securing a stock of lambs for next year; or that a stockholder would offer eight thousand sheep to any one that would remove them from his runs, and finding that no one could be prevailed upon to taint his own flocks by accepting so dangerous a present, had recourse to consuming them by fire, and had actually killed and burnt two thousand.* Such

* The sad destruction of property here described will, we trust, not again occur, or at any rate not be attended by the same pecuniary loss, for it appears that considerable attention has lately been bestowed in boiling down the sheep for the sake of the tallow, which is prepared for the English market, and thus, in such cases as that described in the text, a considerable portion of the value of the sheep may be saved. The colonist cannot be otherwise than aware that the flesh, as well as the bones, form the most valuable of all manures, and if well mixed with earth and made into a compost, its application to the land under cultivation will abundantly repay the cost of labour, dear as that cost may be. It appears from the following advertisement, extracted from a Sydney paper, that the preparation of tallow is in many cases the most profitable mode of disposing of the carcases of superfluous sheep. An animal weighing about 60 lbs. will, we understand, generally yield about 25 lbs. of tallow.

'SHEEP-BOILING AT WINDERMERE, NEAR MAITLAND.

'Mr. Wentworth, having engaged a competent superintendent to boil down his own surplus sheep, is willing to accommodate the settlers in the districts of the Hunter, Wellington, Liverpool Plains, and New England, at the following charges:—

'Slaughtering, skinning, cutting up, and boiling sheep, rendering caul and kidney fat separately, packing the tallow and boiled fat in the sheep skins, in suitable and secure parcels for exportation, marking and lettering

things are nevertheless perfectly true. I myself know the parties; and it all goes to prove that everything depends upon the healthiness and character for feed and water of the country in which a stockholder locates, and the freeness from disease of his stock, and not so much upon his commencing with what is called a great bargain. The first object on the arrival of every settler should be to procure a good country for his flocks, and this, I have elsewhere said, is his grand difficulty. Let him be wary upon this point. Almost every desirable or habitable spot in the old countries, as the early settled districts are called, is already occupied; but there is ample space in the south or north, and will be, I believe, for years to come, though enterprise is fast penetrating into these regions also; I have recommended a box and apple-tree district as the best, but in these he may find that there is no water, or that in times of drought it has been known to fail; or again, where water is always abundant, the forests may be of stringy bark, which always denote a district of inferior value, or even not worth possessing at all. He will be told that Artesian wells may be sunk, by which water may always be obtained; but though too much cannot be said in favour of Artesian wells, they are not calculated for the purpose of washing sheep. Troughs filled by these wells may supply sheep with drink; but the grand object in the possession of flocks is their wool, and means of duly preparing *that* must always be kept in view. A dry climate is essential to the Merino, and one not too cold in winter, and therefore too great an elevation above the sea is objectionable; a short distance from some water-carriage is equally indispensable.'

What this country appears to want is a more general and

those bags so as to distinguish the quality, and putting the same on board the steamer at the Green Hills—at per sheep, 9*d.*

'Washing skins, taking off the whole of the wool, drying and putting into clean packs, and carrying those bales to the steamer—at per sheep, 3*d.*

'The proprietor of the sheep will have to pay the freight of the wool and tallow to Sydney; or if he should wish it to be paid for him, he must, before boiling the sheep, give notice of such to the superintendent at Windermere, who will take at his option, wool at 1*s.* per lb., or tallow at 2½*d.* per lb., in payment of all eharges: the freight of wool being 7*s.* per bale to Sydney, and of tallow 1*s.* per cwt. The goods will be shipped on board the steamer on account and risk of the proprietor.

'Grass will be provided gratis, and shepherds will receive rations at a moderate charge. And if required by the master, the wages coming to them will be paid, and deducted at the above rates.

'The offal and refuse of the carcass, after extracting the tallow, to belong to the establishment.

'Such of the hind legs as may be required for the use of the establishment will be allowed for at ½*d.* per lb.'

systematic arrangement in the modes of management, and a greater combination amongst those interested in the same pursuit. 'There is no union or spirit of co-operation,' says Mr. Hood, 'amongst the settlers, any more than there is among the storekeepers; not so much even as would induce them to establish, what is evidently for their common interest, a public market, for the purpose of keeping themselves out of the power of the Sydney butchers, who at present dictate both as to time and price, in all the sales of fat stock.'

When we bear in mind that in 1840 there were no less than 1,334,593 sheep, and that the export of wool from Australia in 1843 was 16,226,400 lbs.—when we consider the vast importance of this growing trade, its actual amount, and its value to the mother country as an outlet for her manufactures—we feel a strong conviction that, in spite of recent disasters and present distress, it will not be allowed to drop or dwindle; but with the brighter prospect of the general affairs of the colony, the cultivation of wool will again receive a stimulus, and again enjoy a career of prosperity which, though not so rapid as before, will, we trust, be more steady and permanent, and based on surer foundations. As the colony increases in population, and other branches of agriculture obtain attention, some regard will be paid to the carcass of the sheep, as well as the wool; and while the more distant settlements will continue to be the great breeding districts, those nearer the ports will probably be more devoted also to fattening those sheep, purchased from the more distant flocks, at the most suitable age for the market.

It would greatly facilitate the prosperity of these valuable colonies if an Agricultural Society were established, after the model of the Royal Agricultural Society of England. The annual journeys to the metropolis for the sale of wool, which now too frequently ends in the dissipation of a great portion of the funds of the colonist by extravagance and improvidence, may then be made available for the communication of ideas amongst the farmers, a mutual giving and receiving of the knowledge derived from experience—a fund which all may supply, and all receive in return abundant interest. Premiums may be given for the best wool and the best animals of all descriptions; the aids of science may be obtained; the results of machinery taken advantage of; and each colonist return to his station a wiser and a better man.

It is satisfactory to find that the favourable anticipations in which we indulged in the text nearly thirty years ago have been more than realised. And although the discovery of gold at first disturbed the wool and sheep trade, in common with every industry, yet on

the whole it has abundantly atoned for temporary injury, and has since greatly contributed to the prosperity of all legitimate trades, that of sheep coming in perhaps for the largest share. The utilisation of the carcass, which formerly was a drug, is due to the increased demand for animal food; and the various companies got up for its preparation have greatly contributed to supplement the profits of wool. We have seen with what small beginnings the cultivation of sheep commenced, even during the existence of the present work, and now the number in the Australian colonies greatly exceeds those of the mother country, and bids fair to go on increasing.

PART II.—THE STRUCTURE AND ECONOMY OF THE SHEEP.

GENERAL VIEW OF THE STRUCTURE OF THE SHEEP.

The body of the sheep resembles, in most respects, that of the ox; with a somewhat less degree of nervous energy, it possesses a greater capability of enduring the extremes of cold and heat, and still stronger digestive organs. Much of the nervous energy is, indeed, expended on these parts; and a diminished degree is possessed by the organs of locomotion and sensation, in which respect both the ox and the sheep differ considerably from the horse.

The body of the sheep, in common with other animals, is composed of solids and fluids, the latter exceeding the former in weight in the proportion of six or eight to one. To the solids, however, is due the organisation of the frame, for they surround and contain the fluids. Late anatomists consider that animals are composed of three forms of tissues, which they have denominated the *fibrous*, the *lamellar*, and the *globular*. The two former are exemplified in the structure of the cellular substance, which composes the greatest proportion of the animal fabric: the fibrous is characteristic of the muscular and ligamentous structures; the fibrous united with the granular is exhibited in the texture of the glands, and in the medullary substance of the nervous system; and the globular is shown in the composition of the chyle, of the blood, and also other secretions. These several textures being combined together in different proportions, constitute the various organs of which the body is composed.

To give support to the animal, and afford fixed objects for the attachment of various parts, is the office of the *skeleton*, which is composed in the sheep of nearly two hundred bones of various sizes and shapes. These bones, in order to admit of motion, are connected one to another by means of strong bands called ligaments, the ends of the bones being constructed in various ways so as to admit of motion; in many we have the form of a hinge, in others that of a ball and socket. The motion of the limbs in

effected by means of the *muscles* or flesh, which, although to a casual observer appearing as a homogeneous mass, is readily separable into a greater number of distinct bodies of various forms and sizes. These muscles have commonly two separate attachments, which are usually bones, and by contracting in length they bring these points of attachment nearer to each other. Muscles are composed of a vast number of fibres, which, on being acted on by nervous influence, diminish in length and increase in bulk, and thereby approximate the different objects to which they are attached. They are usually fastened to bones by means of a strong white substance called *tendon*, which, however, possesses in itself no power of contraction, but merely communicates the contractile force to the object to be acted on. Where the two objects of attachment are distant from each other, the greater portion of the distance is occupied by the tendons, the advantage of which is owing to their diminished size in proportion to their strength; thus we find the legs of sheep below the knee are light and slender, from the absence of muscular and the substitution of tendinous substance. The greater part of the muscles are voluntary, being under the control of the mind; but some are involuntary, such as the heart and the diaphragm. The muscles or flesh, with the fat interspersed, form the most valuable and nutritious portion of food, and thus those breeds are most valuable in which the flesh abounds mostly in proportion to the bones and sinews.

Muscles are extensively supplied with vessels of various kinds, such as *arteries* for their nourishment, and *veins* for the return of the blood after this purpose is effected. They have likewise *nerves*, which not only furnish sensation, but also communicate to them the mandates of the will.

These nerves proceed either from the brain or spinal cord, which, therefore, may be considered as the fountain of sensation and the residence of the mind. And thus sensation is first sent from the extremities to the brain by the nerves, and then by another set of nerves the will is conveyed to the muscles.

The *brain* is a soft pulpy substance contained within the head, and the spinal cord is somewhat similar in structure, and extends from the brain to the tail, through a hole in the bones which form the spinal column. The body is divided into two principal cavities, the *chest* and the *abdomen*, and separated by a muscular partition called the *diaphragm*. The former contains the *heart* and *lungs*, whose uses are principally to purify and distribute the blood by means of *respiration* and *circulation*. The latter contains the *stomach* and *bowels*, in which the functions of *digestion* are carried on, besides several important glands, such as the *liver*, *kidneys* and

pancreas, together with other supplementary parts. Both the small and large intestines are fastened to the spine by means of a strong membrane called the *mesentery,* which, besides veins and arteries, is furnished with a vast number of small vessels called *lacteals.* These *lacteals* open into the intestines, and there absorb the nutritious part of the food, which is a white milky fluid called the *chyle,* and convey it to a vessel running along the course of the spine, which empties itself near the heart into the circulating system. Thus by these means the blood becomes enriched with nutriment, and is thereby enabled to supply the constant waste the system is continually undergoing.

The *blood* being furnished with nutriment, requires to be purified before it is fit for circulation; for this purpose it passes into the right side of the heart, by the muscular contraction of which it is sent to the lungs, where it becomes exposed to the action of the atmosphere, by which it is changed from a dark to a light red colour, and being freed from impurities, it enters the left side of the heart, and from thence is sent, by means of the arteries, to all parts of the body, supplying every part with nourishment, and furnishing the various glands of the body, not only with their own proper nourishment, but with material for the secretion of their peculiar fluids. Thus the salivary glands separate the saliva from the blood; the pancreas, a juice somewhat similar; the testicles, the semen; and the kidneys, the urine. Each gland separates its peculiar fluid, and no other. The urine, being secreted by the *kidneys,* is conveyed by means of two small but long tubes into the bladder, whence it is excreted from the body.

The *liver* is nourished by the arteries, but separates the bile from the dark impure blood, which is conveyed to it by a large vein. The contents of the bowels are passed onwards by the influence of their peculiar action, and having had the nutritious part extracted, are excreted from the body, generally in a solid form.

The *cellular membrane* is a very elastic substance, and enters largely into the composition of the body; it connects the various glands together, forms frequently a covering for the muscles as well as for various vessels, and exists in the form of cells, which have communication with each other.

The *adipose membrane* is found in various parts of the body, and indeed secretes the fat, which is deposited in a liquid form, and in small circumscribed bags. The *fat* thus contained often performs the important office of affording a cushion for parts that would otherwise be exposed to injury; thus we find that the socket of the eye is abundantly furnished with this material.

There are two other important membranes which are extensively found in animal bodies: they are the *serous* and the *mucous* membranes. Whenever an internal part has an external opening, we find that it is furnished with a mucous membrane which secretes mucus for its protection; but when the cavity has no external opening, then it is lined with a serous membrane which secretes a thin watery fluid to lubricate the parts, and preserve them from injury by friction. Thus from the entrance of the mouth and nostrils to the anus, throughout the whole internal surface of the bowels, a mucous membrane exists, by which the fluid is secreted, the character of which gives a name to the membrane, and which protects it from injury either by the external air or by the contents of the bowels. In like manner we find the bladder and urinary organs similarly lined.

On the other hand, the cavity of the chest and the abdomen, with their contents, as well as the internal surface of blood-vessels, are furnished with a *serous* membrane, which secretes a watery vapour. These different membranes are very frequently the seat of disease, and are subject to severe and dangerous inflammation. The admirable manner in which the various organs are packed away in their proper cavities is worthy of particular notice. The lungs and the heart are so adapted to the shape of the chest, that there is at no time any vacant spot; and the more numerous contents of the abdomen are so disposed, that while each has sufficient freedom for the proper performance of its functions, yet the whole are packed away with the most economical care: there is no void whatever to be found.

SKELETON OR BONY STRUCTURE OF THE SHEEP.

The skeleton of animal bodies is formed of bone, a substance possessing firmness and stability for the attachment of muscles, the protection of the vital organs, and the support of the softer parts. It is composed of animal matter and earthy salts; the former consisting of cartilage, gelatine, and fat or marrow, and the latter of phosphate of lime in considerable porportion, a lesser quantity of carbonate of lime, and a small portion of other salts. The cartilage of bones is formed before the earthy matter, and constitutes, in fact, the nidus in which the latter is deposited. Bones can be freed from their earthy portion by immersion in an acid, by which process the gelatine is also dissolved, and pure cartilage, which is elastic, but retains the original figure of the bone, is left. On the other hand, bones, by exposure to a great heat, are deprived of the animal substance, and the earthy part remains.

The use of the *marrow* is more particularly to prevent the too great dryness and brittleness of bones. To the animal portion of their compostion they are therefore indebted for their shape and what degree of elasticity they possess, and from the earthy portion they derive the important purposes of strength and stability. Thus are these different elements combined together, and by an union of their different principles form a substance admirably adapted for affording full scope for the play of the various organs of life, protecting at the same time the vital parts from external injury, admitting and assisting the powers of locomotion, and, in fine, forming a secure fabric for the beautiful building of animal frames.

Every bone is covered by a membrane called the *periosteum*, which also lines the internal cavities and secretes the marrow; its use is to circumscribe the form of bones and protect them by its tenseness, as well as to afford the medium whereby they are furnished with their vessels. The shape of particular bones intimately corresponds to the purpose for which they are intended; where for the office of protection we find them flat, and where for the purpose of motion, long and cylindrical, as in the extremities.

The Bones of the Head.—In the construction of the skull the most perfect mechanism is displayed. The first object to be obtained is the protection of the brain from the accidents to which, from the peculiarities of animals, it is mostly exposed. For this purpose the skull consists of two tables or plates; the outer thick and tough, the inner hard and brittle; the former, by yielding in a measure to resistance, diminishes concussion, whilst the latter, by its hardness, prevents sharp bodies from penetrating to the brain. Now, if these two plates were reversed, the brittle would not only be in great danger of fracture, but would also vibrate considerably; and the injurious effect of this vibration may well be conceived when we are told that, even with the present wise precaution, it often occasions in the human subject greater mischief than the most serious fractures.

There is a remarkable difference in the appearance of the head in the horned and the polled sheep; the former have a more pugnacious, and it may be a more sensible, appearance, owing to the elevation and projection of the upper part of the head. This, however, is in appearance only, for the prominence of the head is not formed by any increase in the brain, but is owing to the considerable space which exists between the two tables of the skull, the outer being half an inch or upwards from the inner. This separation accomplishes two purposes, one being the additional security it affords to the brain by the interposition of this vacant space, and the other the greater root or basis it furnishes to the

horns. And when we consider that horned sheep are generally more pugnacious than others, and that they have not only the will, but the power of butting each other with great force, the additional security is not without use. In fact the brain is seated so much beneath and behind the forehead, that very little of the shock can be communicated to it. This circumstance, too, operates in affording protection to the polled sheep as well. Between the skull and the brain are interposed several membranes, which also assist materially in preventing vibration, like a piece of parchment on the inside of a glass vessel. The skull in quadrupeds is composed of npwards of thirty bones, which are connected together by dovetailed sutures. It used to be considered that the object of this extensive division of the bones was the convenience of ossification, which always commences at the centre; but a more extended view has discovered other wise purposes; for not only is the dovetailed suture the strongest mode of union, but it is also the best adapted for securing the brain from injury, as it yields considerably to the impression received, and thus wards off both concussion and vibration. There is an exception, however, to this usual connexion in the temporal bones which form the sides of the cranial cavity, and which are connected to the other bones by what is termed the squamous suture—one bone, in fact, simply overlaps another. This union is inferior in strength to the former; but nature has here another office to perform, and the reason of this exception will at once be comprehended on examining the skull. If a considerable blow be received on the upper portion of the arch, its sides are the parts most likely to give way; and to guard against this consequence the under bone overlaps the upper, and thus acts like the tie-beam of an arch in keeping the parts together. This dovetailed suture does not connect the bones of the inner table; for, though a carpenter might find this mode of union serviceable in joining the sides of a wooden box, it would by no means be found applicable in connecting together brittle substances, as it would be extremely liable to chip off at the edges.

The *cranial* cavity, or that part which contains the brain, is not more than a third the size of the other parts of the skull, the remaining portions being devoted to mastication and smelling.

There are no less than nine bones which enter into the composition of the cranium. The two *frontal* bones form the anterior part usually called the forehead; but the internal plate of these bones separates and recedes from the external plate so as to form a cavity between them, which is called the frontal sinus, and is divided by a septum or ridge of bone between them. The internal

plate forms a covering for the anterior lobe of the cerebrum. In horned sheep the separation of the plates of the frontal bones is considerably greater than in others. The horns proceed on each side from the frontal bone, and seem, as it were, prolongations of the bone; for although externally we find the structure of horn, internally we have bone, and between this horn and bone we find the vascular structure by which both are secreted. In many animals the age can be judged of by the horn, which each year presents an additional ring round its base. In the cow this is not an uncertain guide, and it is owing to the irregular growth of the horn at different periods of the year, growing probably with greater force in the spring than in the winter; but in the sheep, although the same causes obtain, yet it cannot be depended on with accuracy. At the root of the horn we observe a cavity which communicates with the frontal sinus.

The two *parietal* bones are proportionately shorter than in the horse, and are situated at the upper and middle parts of the cranium, and cover the middle lobes of the cerebrum, to which their internal part closely corresponds.

The *occipital*, a single bone of great strength, is found at the back and base of the cranium. Its internal surface covers the cerebrum, and on a strong process at the base the *medulla oblongata* rests. The external surface of this bone is extremely irregular. At its lower and back part is the occipital hole, through which the spinal cord, as well as some nerves and an artery, make their exit from the brain. On each side of this hole the bone is smooth and rounded for the purpose of articulating with the *atlas*, the first bone of the neck; besides which there are several curious processes for the attachment of muscles.

The *temporal* bones forming the sides of the cranium are composed of two parts, the squamous and the petrous. Though in man these pieces are united, yet in the sheep they are distinct from each other. The squamous portion is externally a convex plate, with a hooked projection arising from it; this process assists in forming the *zygomatic* arch. The squamous portion affords at the posterior part a shallow cavity for the articulation of the lower jaw-bone. This *glenoid* cavity, as it is termed, is much deeper in carnivorous animals, which require to open their jaws more extensively; and an inspection of this portion of the skeleton alone will enable the comparative anatomist to decide to what order the animal might have belonged. In herbivorous races a grinding lateral motion of the jaws only is required, and accordingly the articulation is wide and shallow. The *zygomatic* arch, too, is much more arched in the carnivora, in order to afford more room for the

development of the temporal muscle, which governs the jaw, than is required for the more moderate exertions of herbivorous animals. The petrous portion of the temporal bone, so called from its rocky nature, is apparentiy a solid convex figure. It contains, however, the organ of hearing, and has on its internal surface orifices for the passage of the auditory nerve, and on the external we find a larger orifice for the passage of sound. The internal structure of this bone is as beautiful as it is curious, possessing vestibules and canals for the ramification of the nerve, and a singular cavity having a communication with the mouth, in which are discovered four diminutive bones, with their corresponding muscles, which serve the purpose of propagating and modifying the sound.

The inferior and middle parts of the cranium are formed principally by the *sphenoid*, a bone which somewhat resembles a bird in flight, having a body and four processes, two of which are called the wings and two the legs. This bone supports the middle lobes of the cerebrum, and presents holes and depressions for the passage of nerves. The cranial cavity is separated from the nasal by the *ethmoid* bone, which also somewhat resembles a bird in flight, but without legs, and is situated in front of the bone last described. It supports the anterior lobes of the cerebrum, and has holes for the exit of the olfactory nerves; and on its internal and inferior surface it forms cavities called the ethmoidal sinuses, which are separated by a long septum from each other, and are perforated by a vast number of small holes for the passage of the olfactory nerves to the nasal cavities. It is this thin part of the bone which is penetrated in the operation of wiring giddy sheep. Such is a brief description of the various bones which form the cranium and envelop the brain, and which are connected together and arranged on principles more durable and economical than can be displayed by the noblest specimens of mechanical skill.

The *face* occupies a larger portion of the head than the cranium, but is less in proportion than the ox and the horse, and particularly the latter animal. Its upper part is formed by the lower portion of the *frontal bones*, which are considerably longer in the sheep than in the horse, descending much lower down, and in fact forming the roof of a great portion of the nasal cavity. Another peculiarity in these bones is, that whereas in the horse they descend in a straight direction, in the sheep, just above the orbit, they form almost a right angle.

The *nasal* bones are much less developed in the sheep than in the horse.

The *superior maxillary* bones, though relatively smaller than in the horse, yet form a great portion of the face, extending the

whole length of the molar teeth, for which these bones form suitable sockets, and laterally from the molar teeth to the frontal and nasal bones. Within the cavity of the mouth these bones form the roof of the palate, being united together by a suture. This portion of the bones is wider though shorter than in the horse, so that the molar teeth are farther apart, and the mouth thus gains in width what it loses in length. Thus situated, these bones have three surfaces—the facial, the nasal, and the palatine. At the superior part of their palatine surface we find what are called the *palate bones*, which, in the horse, chiefly consist of narrow curved bones, forming together the semi-oval border dividing the cavity of the mouth from that of the nostril, and serving for the attachment of the soft palate. In the sheep, however, these bones extend further down into the mouth, and are indeed a portion of the palate, which, in the horse, is formed of the maxillary. The border, too, instead of being nearly semi-circular, is almost conical, from being so very narrow. The consequence of this structure is, that the upper entrance to the cavity of the nostrils is smaller in proportion than in the horse, and the soft palate is less developed, so as not to close the cavity of the mouth. The nature of the sheep corresponds with this structure: not being an animal of speed, it does not require to inhale so much atmospheric air; and the purposes of rumination require the food to ascend from the stomach to the mouth, which it could not do if the soft palate were constructed as in the horse, where it closes the back part of the mouth, except when food is passing from the mouth towards the stomach.

The *anterior* or *inferior maxillary* bones, which are wanting in the human subject, are attached above to the superior maxillary bones, and thence descending and enlarging, in the horse form the sockets of the upper incisor teeth, but in the sheep and other ruminating animals not possessing these teeth, they become smaller instead of larger as they descend, merely forming the basis of the hard pad which meets the under incisor teeth.

The *molar* bones, irregular in shape, and comparatively larger in the sheep than in the horse, are situated on the sides of the face above the large maxillary, and partly within and partly without the orbit of which they form the lower part.

The *lachrymal* bones, so called because the lachrymal duct for the conveyance of the superfluous tears to the nostrils passes through them, is situated about half within and half without the orbit, the latter portion being between the molar and frontal bones —a different arrangement from that which obtains in the horse. The orbit or bony socket which contains the eye is thus composed of a variety of bones.

There is a long but very thin bone, called the *vomer*, situated at the floor of the nostrils, and running throughout their length, and having a groove into which is embedded the cartilaginous substance which divides the nostrils into two equal cavities.

The *posterior maxillary* or lower jaw-bone is formed of two halves, united at the inferior part by cartilage in the young subject and by bone in the adult. This united portion forms the sockets for the eight incisor teeth, which sockets, however, are by no means so deep or so strong in proportion as in the horse, and thus it is common for sheep to lose or break these teeth soon after they are fully developed. From the place of junction the lower jaw-bones separate and gradually recede from each other, becoming wider and deeper, and forming strong and secure sockets for the molar teeth, after which the bones become thinner, turn upwards, and terminate in two extremities, one rounded, forming, with the temporal bone above, the maxillary joint, and is secured from displacement by a hook-like projection which is the other termination of the lower jaw-bone.

The bones which we have mentioned as composing the face are none of them solid in their structure, but most of them hollow, and thus various cavities are formed which are called after the bones in which they appear. Accordingly we have the *frontal*, the *maxillary*, the *sphenoidal*, the *ethmoidal*, and the *palatine* sinuses. The frontal are the largest and most important, particularly in the horned sheep, in which they are partly divided into cells and communicate with other sinuses immediately surrounding the horn. These singular cavities are not found in the young subject, but are gradually formed as the size of the head increases. They thus serve the important purpose of increasing the size of the head without adding to its weight.

The Bones of the Body.—The *neck* is formed by seven bones, which, with the exception of the two first, are very much alike. The first is connected with the occipital, or bone of the skull, with which it forms a joint possessing much motion in a vertical direction. In the human subject it is termed the *atlas*, from its supporting the head. It forms a joint behind with the *dentata*, as the second bone is termed, from its having in the front part a process like a tooth, which, however, affords the head considerable lateral motion. All the bones of the neck are extremely irregular in shape; they all possess a large hole through the centre for the passage of the spinal marrow, and small ones at the sides for the exit of nerves and arteries. They have also projections on each side and above for the attachment of muscles, and each one

forms a joint both before and behind which affords that great flexibility to the neck which most animals possess.

The *back* or *chine* is composed of separate bones called vertebræ, of which there are thirteen belonging to the back alone. They all possess, like those of the neck, a hole through the centre for the passage of the spinal cord, as well as a small one at the side for the exit of the nerves. The superior projections or processes are much higher than those of the neck, but considerably shorter than we find in the horse; and thus we have high withers in this animal and low ones in the sheep, and they are also shorter in the improved breeds than in the wilder races of sheep, a channel between the shoulders and along the back being justly regarded as a sign of a disposition to fatten. These processes serve for the attachment of muscles, as well as of a strong elastic substance which is attached to all the bones of the neck as well as to the occiput, and serves to support the head, and thus relieves the muscles to a great extent.

The *ribs* are attached to the vertebræ by means of a joint—one rib is joined to two vertebræ, and *vice versâ,* thus permitting the former a certain extent of motion. There are thirteen ribs on each side, eight true and five false; the former are attached to the sternum or breast-bone, and the latter are merely joined to the former at their lower parts, which is formed of cartilage. The ribs should spring from the back-bone as horizontally as possible, as thereby the rotundity of the frame is increased.

The *loins* are formed by five bones, which partly resemble the bones of the back; but instead of ribs springing from the sides there are fixed bony processes, several inches in length, which afford a protection or roof for the abdomen. These processes, in a well-formed sheep, should be long and horizontal.

After the loins the spine continues in the *sacrum,* which, in the lamb, is composed of separate pieces, but is consolidated into one bone in the sheep. This bone is perforated for the passage of the spinal cord, which, however, diminishes in size, and terminates at the end of the sacrum in several nerves which run to the tail. The bones of the tail are numerous, but are not perforated.

The Bones of the Fore Extremities.—The joints or articulations of the extremities are the same in number as those of the horse; but the limbs, on reaching the fetlock joint, become divided, and the four bones situated below the fetlock are consequently double. The *scapula* or blade-bone is similar in shape to that of the horse, having a spine or ridge down its middle for the attachment of muscles; but in sheep the bone is not so long in

proportion to its width. It is attached to the ribs by muscular substance, by means of which the body is suspended or hung like a carriage between the two fore-legs, and concussion is thereby materially diminished. From the more circular shape of the ribs, the shoulder-blades are attached to them with much less mechanical advantage so far as speed is concerned. They are placed wider apart, both above and below, but particularly at their lower parts, so that the limbs spread open, at a greater angle, much more like a pair of compasses than do those of the horse, and even the ox, thus giving the sheep that rolling walk so peculiar to the animal and so disadvantageous with regard to speed.

The *humerus*, or shoulder-bone, strong and cylindrical, forms with the blade above the shoulder-joint, the action of which, with that of the elbow-joint below, is more limited than that of the horse.

The *radius* or bone of the fore-arm is comparatively shorter than that of the horse, and we find that it is always long in animals of speed and short where speed is not required: this bone is also strong and cylindrical.

The *ulna*, or bone which forms the elbow, does not support the weight, but serves for the attachment of the powerful muscles so conspicuous in a shoulder of mutton, and which are generally divided by the first cut. For this purpose it is attached to the radius, and rises above the elbow-joint, the back of which it forms, but does not reach the knee. This joint, the *carpus*, is composed of seven bones, arranged in two rows, the upper of which articulates with the radius, and the lower with the cannon or metacarpus.

The *metacarpus* or shank much resembles that of the horse, until it reaches the fetlock, where it is to some little extent cloven, so as to articulate with the double arrangement of the bones below. Instead of the two small metacarpal or splent-bones that we find in the horse, there is merely one, and that of small extent and use.

The small bones situated at the back of the fetlock, called the *sesamoids*, and which serve as levers for the attachment of ligaments and the action of the sinews, are double those of the horse, being four in number.

The bones below the fetlock, viz. the large pastern or *os suffraginis*, the small pastern or *os coronæ*, the *os pedis* or coffin-bone, and the *navicular bone*, are all double; and, like the same parts in the ox, somewhat resemble in shape the bones of the horse sawn in two.

All these joints have less extent of motion than we find in the

horse, and the bones therefore present a more upright appearance. In the horse and in the ox an angle is formed at the fetlock with various degrees of obliquity, and the three bones below pass down in a straight line though in an oblique direction. In the sheep, however, there is a different conformation; the large pastern-bone passes down in an oblique forward course, as in the ox, but the small pastern descends in a perpendicular direction so as to form an angle with the bone above almost as great as, though precisely opposite to, that of the fetlock-joint. This it is which gives the more upright appearance to these parts in sheep, though the cause is not externally visible, and it throws the centre of gravity on the back part of the coffin-bone and on the horny heels of the foot. The small pastern bone is relatively longer than in the horse, and there is more motion in the pastern-joint, though much less in the fetlock; indeed the action of the former is quite as much as the latter.

Though not belonging to the skeleton, this will yet be the most convenient situation for noticing the structure of the other parts of

The Foot.—The bones dividing at the fetlock, the tendons likewise, both before and behind, become divisible, and there are consequently two flexor tendons or benders and two extensors to each division. The former, as in the horse, consists of a perforans and a perforatus, the latter forming a sheath for the perforans just above the fetlock, in which it continues to the small pastern-bone, into which the perforatus is inserted. The perforans then glides over the back of the navicular bone, which forms a sort of pulley, and is inserted into the lower and back part of the coffin or foot-bone. Of the extensors one is inserted into the upper and front part of the small pastern, and the other is continued to the coffin-bone. These bones are connected together by capsular and other ligaments; and there is one very strong one in particular, which passes from the lower, inner, and anterior part of the large pastern in a perpendicular direction to the inner and back part of the coffin-bone. To the lower and back part of the coffin-bone is attached an elastic pad of a fibrous and ligamentous nature, which receives the greater part of the superincumbent weight, and by yielding to it takes off the jar. It rests on the horny heels of the foot, which thus supports the principal part of the animal's weight, very little resting on the anterior portion of the foot. It is thus very evident that there is a considerable difference, both in the structure and functions of the various parts of the foot, in the sheep and in the horse. In the latter we find that the crust or wall of the foot is connected to the coffin-bone by means of a

double arrangement of a vast number of horny and fibrous plates, the former connected with the inside of the crust, and the latter with the coffin-bone. These laminæ, as they are called, are dove-tailed together, and thus the connection is rendered of great strength; and the vast extent of surface thus afforded, and the elasticity of the parts, obviate concussion, and afford indeed an admirable spring and a principal cause of the elastic tread of the animal. In the ox we observe an arrangement somewhat similar, though the laminæ are much less developed; but in the sheep, so little weight being supported by the crust and front part of the foot, such a complicated structure is not required, consequently we find no laminæ, but the crust is connected to the bone by a simple vascular structure, which secretes the principal part of the crust, in the same manner as the side or lower part of the foot is formed. The coronary substance which in the horse secretes the greater portion of the crust is wanting in the sheep. The sole of the foot is secreted as in the horse by the vascular membrane above, and there is a greater thickness of this dense substance interposed be-the coffin-bone and the sole of the foot.

We can thus understand from this description how it is that the horn of the foot is so speedily restored in sheep when the hoof is lost in foot-rot or the epidemic by the matter insinuating itself between the horn and the bone; it has not, as in the horse, to wait for the slow and tedious growth of the horn from the coronet downwards. The inside of the crust is considerably thinner and weaker than the outside, particularly towards the back part, where foot-rot most frequently commences.

The horny part of the foot may be considered to consist of the crust, or wall, and the sole. The former surrounds the outside of the foot and turns inwards at the toe, and passes in a straight direction to the heels. It is thickest at the toe and thinnest on the inside. The sole is situated at the bottom of the foot between the outer and inner part of the crust, but it is difficult to say where the crust ends or the sole begins, the structure of each being so much alike. The heels are formed both by the crust and the sole, though principally by the former, which turns inward and joins the inner crust; and it here becomes more elastic and spongy, resembling very much the frog of the horse. This part supports the principal part of the weight, and suffers most when sheep are driven much on the hard road.

We have yet to notice a very singular peculiarity in the foot of the sheep, which is

The Biflex or Interdigital Canal.—The large pastern-bones are connected together by a ligamentous substance, and it is

not till the pastern-joint is reached that the foot becomes exteriorly disunited. At the situation of this joint in front we can detect an opening sufficiently large to admit a small probe; this is the entrance of the canal just spoken of, which presently enlarges, and passes first downwards, and then winds round in a semicircular direction, ending in a sort of *cul de sac.* On cutting into this canal it appears to be a duplication of the skin; its internal surface is lined with hair, and there is found a considerable quantity of detached hair mixed with a waxy secretion in the canal, secreted by various glands. This hair is no doubt excreted from the internal surface, and which, from the smallness of the opening, cannot escape, or rather is detained for a useful purpose. The use of this canal thus stuffed with hair is self-evident. We have mentioned the great motion possessed by the pastern-joint, which is so great as to threaten to chafe the skin by the friction of one side against the other. It is to prevent or ward off this friction that this biflex canal, or rather hair-stuffed cushion, is provided; and it acts, indeed, precisely like the fenders which are lowered down the side of a vessel to prevent it coming into contact with another. The ox possesses little or no motion in this joint, and consequently requires no such provision to prevent friction. The benevolence of Nature is strikingly exemplified by this simple structure. This part occasionally suffers from the insinuation of dust and sand, and is subject to inflammation and ulceration, which sometimes prove very troublesome.

The Hind Extremities.—The *haunch* is formed by three bones in the young subject, but these bones soon become consolidated into one, and is called the pelvis or basin, within which are situated the bladder and part of the organs of generation. Viewing this bone from below it appears pretty nearly circular within, but externally the circle is broken by various irregular processes, two of which project upwards on each side the spine which lies between them; then two others extend backwards below the tail, and are called the haunch bones, and two project laterally which are termed the hips. These bones project but little in a well-formed sheep, being altogether clothed with flesh and fat.

The bones of the *pelvis* extend downwards and backwards from the spine, and towards the inferior part form on each side a deep cap or socket, into which fits the upper part of the thigh bone, which is formed like a ball, so as to fit into the socket. The thigh bone, or *fœmur*, extends forward, and is relatively longer in the sheep than in the horse. It is the flesh surrounding this bone which composes the bulk of a leg of mutton. Its lower part forms, with the *tibia* below, the *stifle* joint, which has two car

tilaginous bodies within it, and is protected in front by a small bone called the *patella* or knee-pan: this bone becomes a sort of pulley, receiving the insertions of the powerful muscles above, and is attached below to the tibia by strong ligaments.

The *tibia* or leg bone runs backwards from the stifle, and is not so long in proportion as in the horse; it corresponds to the radius in the fore extremity, and it forms the upper part of the *hock* joint.

This joint is composed of six bones arranged in rows so as to form three articulations, but motion is confined to the upper, formed by the astragalus or knuckle bone and the tibia; the other bones serve as cushions to diminish concussion, with the exception of the *os calcis*, situated at the back, which acts as a lever receiving the insertions of the powerful muscles which straighten the hock. This bone is much shorter than in the horse, speed not being required. The bones below the hock correspond with those found below the knee in the fore extremity.

THE MUSCULAR AND NERVOUS SYSTEMS.

The Muscles.—Although the shape of the body depends materially on that of the skeleton, so that if the latter is faulty the former will not be perfect, yet there is a very great contrast between the appearance of the skeleton and that of the body itself, of which it forms a part. Whilst the former is angular and extremely irregular, the latter is round and smooth, so that though the good shape of the animal depends on the skeleton, yet it requires the eye of the anatomist to detect, in the conformation of the latter, the good points which in the body itself are readily observed.

The bulk of the body is formed of flesh or muscles; their principal use, when living, is to effect the movement of the limbs; when dead, to afford nutriment to man. The motion of the body is occasioned by the contraction of the muscles, which, being fastened to different bones, draw these bones towards each other, and thus the limbs are bent whenever particular muscles shorten or contract. These muscles, which bend the limbs, are called the flexors, whilst an opposite set which straighten them again are denominated the extensors; the latter, however, are mostly smaller and weaker than the former. The size and shape of muscles are very diversified, some being so minute as to be scarcely visible, as those within the ear; whilst those of the loins and buttocks are large enough to afford a feast for many persons when

brought on the table, either as a saddle, embracing the loins on both sides, or the haunch, comprehending both loin and leg on one side; some muscles are thin and spread out like a fan; others are thick and bulky; and whilst some are extremely short, others are cylindrical and of great length. Muscles are furnished with nerves both of motion and sensation: the former convey the mandates of the will, and are thus the cause of motion; the latter communicate the sense of feeling, and are the medium both of pleasure and pain; but there is a considerably less degree of feeling possessed by the flesh than by the skin. The muscles are composed of fibres, and are bound together by cellular membrane; and they are, in sheep, mostly clothed with fat, which also is deposited amongst the fibres. It is the capability of containing this fat, and the abundance and laxity of the adipose membrane containing it, which distinguishes a sheep of a good from one of a bad breed, and gives to the former that softness and elasticity or resiliency which is felt on handling it, even when poor. The former sheep, too, possesses large muscles, particularly at those parts where the meat is most esteemed. Thus the loins of a good sheep are broad, and abundantly covered with flesh and fat, and so likewise are the buttocks and the shoulders, whilst the head and neck are small. The muscles that are in most constant use are more interlaced with tendinous fibre, and consequently are much less tender, as meat, than those which are less actively engaged. The muscles of the lower part of the legs between the knees and hocks and the joints above, as well as those of the neck and head, are instances of the former kind; whilst the muscles of the loins, and more particularly those within the pelvis, are examples of the latter, and afford the most tender meat in the body.

The Brain and Nerves.—The brain, the seat of the mind and the fountain of sensation, is a soft body situated in a cavity of the skull called the cranium. In man it occupies by far the greater portion of the skull; but in the sheep, from its much smaller size, and from the large space devoted to the face, its cavity the cranium is much the smaller part. It is closely invested by a membrane called the *pia mater*, whilst the cranium is lined by a firm, strong membrane called the *dura mater*. Between these there is another delicate membrane called the *tunica arachnoides*. The *dura mater*, by its duplications, forms several processes and sinuses; the former, by descending between its divisions, serve to secure the brain in its position, and the latter act as reservoirs for the venous blood, thus preventing the brain from being injured by any temporary impediment to its passage. The *pia mater* closely embraces the brain, and dips into its convolutions.

The brain consists of three parts—the *cerebrum*, the *cerebellum*, and the *medulla oblongata*. The *cerebrum* is considerably the largest, and is divided into two hemispheres, each of which closely corresponds with its fellow. On cutting into the cerebrum, we find that it consists of two portions—the medullary or white, and the grey or cortical part. The latter is mostly situated towards the surface, and the former towards the centre, but both appear to run into each other. Within the hemispheres there appear to be various cavities, canals, and membranes, which, in this work, it is unnecessary to describe.

The *cerebellum*, or little brain, is situated behind the cerebrum, than which it is considerably smaller. It appears to consist of medullary and cortical substance mingled together.

The *medulla oblongata*, the smallest division, is situated at the base of the brain. It is medullary in its structure, and gives origin to the greater part of the cranial nerves. It is by far the most sensible part of the brain, for whilst portions of the cerebrum have been cut away in some animals without giving any apparent pain, the least pressure on the medulla is productive of injury or death. The brain is largely supplied by means of the carotid arteries with blood, which is returned to the heart by the jugular veins.

The *spinal marrow* may be considered as the continuation of the brain, running from the medulla oblongata, throughout the spinal canal. to the tail. It is enveloped by the same membranes as the brain, and continues to the sacrum, where it ends in several nervous cords. Its form is cylindrical, and it has been found to consist of six bands, in the centre of which there is a sort of canal.

The *nerves* arising from the brain and spinal cord, in sheep, are forty pair, ten of which proceed from the brain and the remainder from the cord, and are therefore called the spinal nerves. On examining a nerve, we find that it consists of a vast number of white filaments, each having its particular covering, and yet compactly bound together and invested by membrane. Of the *cranial nerves* the first pair is the *olfactory*, the nerve of smelling, pulpy in its structure, and the largest in the body. It rises from the cerebrum, passes out of the cranium, and is spread out on the membrane lining the nostrils. The second pair, the *optic*, rise from the cerebrum; but, before they pass out of the skull, join together and decussate, the right nerve going to the left eye, and *vice versâ*. Each takes an oblique course, pierces the outer coats of the eye, and is spread out in the form of the retina, and thus conveys the impressions of objects to the brain. The sense of hearing is supplied by a soft nerve, the *auditory*, which enters an orifice in the

temporal bone, where the seat of hearing is contained. The sense of taste is supplied by the fifth, which is a compound nerve, conveying both sensation and motion. The other cranial nerves convey sensation and motion to the various parts of the head. There is one nerve which demands more particular notice; it is the *par vagum*, or *pneumo-gastric* of the French. It rises from the brain, passes down the neck close to the carotid artery, and distributes branches to the pharynx, larynx, and œsophagus, heart, lungs, stomach, and liver. If divided on both sides in the living animal, death immediately ensues. Its importance may thus be readily conceived; it is intimately connected with life itself, giving to the heart and stomach their power of motion independent of the will.

The *spinal* are compound nerves; having a double function, and a twofold origin, they convey both sensation and motion. They arise by numerous filaments from both the upper and under surface of the spinal cord. The filaments coalesce, and, before they emerge from the *dura mater*, join together, previous to which the upper nerve forms a sort of knot called a ganglion. This latter is the nerve of sensation, the other the nerve of motion; and thus, though united together, the filaments are yet distinct, and a part is endowed mostly with sensation or with motion, according as the filaments of the former or the latter predominate.

There is yet another nerve which requires to be noticed as being of great importance. It has been called the *ganglial*, from the nature of its apparent origin, and *sympathetic*, from its functions, but more properly the *great organic nerve.* It appears to arise from a small red ganglion or knot at the base of the brain, and just previous to the commencement of the spinal cord. It appears to have intimate communication with all the other nerves, and distributes branches to all the glands, arteries, and absorbents of the system—the heart, lungs, and digestive organs; it is the soul, as it were of the organic system, influencing the functions of nutrition and secretion.

We have before observed that the brain of the sheep is small as compared with the size of the body. In fact, the whole nervous system is, comparatively, feebly developed, and this peculiarity has a considerable influence over the diseases of the animal, and accounts for the fact that in the greater number debility quickly supervenes, and in many the animal speedily sinks.

THE ORGANS OF MASTICATION AND DIGESTION, &c.

The mouth of the sheep and its contents are admirably adapted for their natural functions. The sheep is intended by Nature to thrive on scanty pasture and to take a considerable bite, and much closer to the ground than the ox. The lips are therefore protected by hair, which defends them from injury from the ground; they approach somewhat to a point, and the upper lip is cleft, which suits it well for the purpose.

Dentition.—The *incisor* teeth or *nippers*, like those of the ox, are situated only on the lower jaw, the upper having instead a firm fibrous pad, sufficiently strong to retain the food between it and the teeth. The incisor teeth are eight in number in a perfect mouth; but the lamb, when dropped, has only two, and sometimes none visible, but in a few weeks the others make their appearance: these, however, are but temporary teeth, smaller than the permanent ones, and adapted to the size of the mouth. By one year old the central teeth drop out, and are succeeded by two larger and stronger teeth—the permanent. These teeth are formed within the sockets in the bone sometime previous to their appearance, and pressing against the root of the temporary incisors, gradually induce their absorption. By two years old the two next teeth have undergone the same change, and are succeeded before the following year by those adjoining, so that by from three to three-and-a-half years the whole eight teeth are thus renewed, and the sheep is then said to be full-mouthed. Although the order and period of these changes are sufficiently regular to afford an adequate criterion for a general rule, yet it is not without exception, as sometimes the permanent teeth appear much earlier, and at others their appearance has been protracted to a later period.

After the sheep becomes full-mouthed, there is no method of judging of the age with accuracy, but the teeth rarely remain perfect long, particularly if fed on turnips; some of them are lost or become broken, and the sheep is then said to be broken-mouthed.

The incisor teeth are somewhat conical in shape, the point being inserted in deep sockets; the portion visible is covered by a very hard transparent material called the enamel, and it is brought to a sharp edge at the anterior part, so that it cuts very much like a chisel. Compared with those of the horse the incisor teeth appear somewhat loose, but this is rather an advantage than otherwise. The food, being embraced between the incisor

teeth and the pad above, is torn asunder by the nodding action of the head, and the food is conveyed by the tongue to the molars or grinders. When turnips, however, form the diet, the food is scooped out, as it were, by the teeth alone, and they are consequently sooner worn out and broken; but even otherwise this effect generally follows a few years after the mouth becomes complete. The *molar* teeth are six in number, on each side of each jaw; they are firmly planted in deep sockets, and their faces are covered with enamel. These faces are very irregular, but admirably adapted for tearing and grinding the tough and unyielding grass; and they are also secured in their positions by means of the gums, which, in common with the other parts of the mouth, are covered with a mucous membrane, and in some parts a firm dense material is interposed between the mucous membrane and the bone.

Since the former edition of this work was printed, a considerable amount of attention has been paid to the subject of dentition, particularly with reference to the means thus afforded of judging of the age, and by no one more than by Professor Simonds of the Royal Veterinary College. Farmers, in classifying sheep for the fairs, usually distinguish them as two-teeth or one-year old or one shear-sheep, and four teeth or two-year old or two shear, as they are called in some districts. It not unfrequently happens, however, that, instead of two central permanent nippers, the sheep has four before he reaches eighteen months, and there is a variation of several months between early and late dentition. However, as an ordinary rule, the existence of two permanent incisors denotes the sheep to be one year old, and the existence of four that he is two years old.

Corresponding changes take place with regard to the molar teeth; but as, from the difficulty of getting at them for examination, they are of less practical importance, we must refer to Professor Simond's elaborate article in the 'Journal of the Royal Agricultural Society' for further information on this subject.

A table of early and late dentition, prepared by Professor Simonds, is of practical utility; we have, however, seen sheep at sixteen and seventeen months old with four permanent incisors. With a latitude of two to three months on either side for early or late dentition, the following will be about the average:—

At 1	year 2	months,	there are	two	permanent	incisors,	a a, fig. 1, p. 104.
„ 1	„ 9	„	„	four	„	„	a a, b b, fig. 2.
„ 2	„ 6	„	„	six	„	„	a a, b b, c c, fig. 3.
„ 3	„ 3	„	„	eight	„	„	a a, b b, c c, d d, fig. 4.

The sides of the mouth are formed by the *cheeks,* which admit the limited motion of the jaws and are connected with the powerful masseter muscles, which form the greater part of the bulk of the

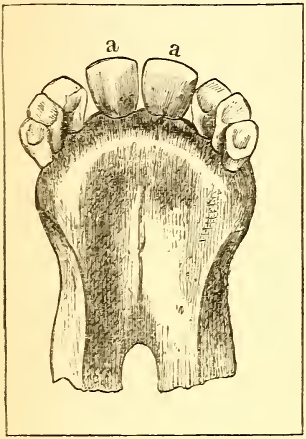


Fig. 1.

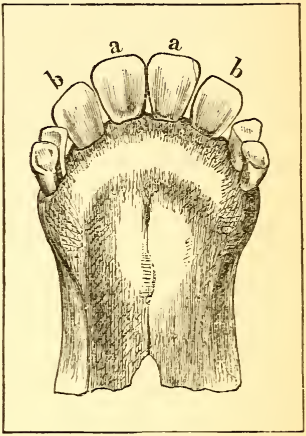


Fig. 2.

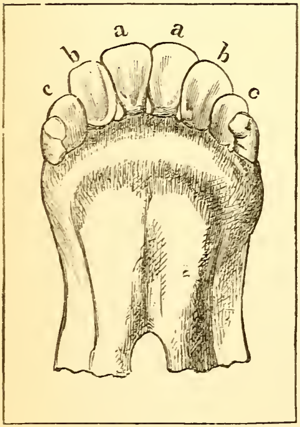


Fig. 3.

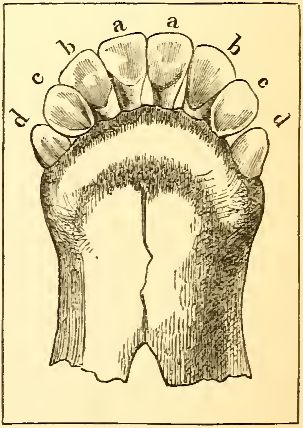


Fig. 4.

face, and principally govern the grinding motion of the jaw. In the skull we find the lower jaw considerably narrower than the upper, but in the living animal this does not appear, the space being occupied by the masseter muscles. The *lips* greatly assist in

gathering together the food, and are largely furnished with the nerves of feeling; they are composed of skin, muscle, and membrane, and possess the powers of motion and sensation in a high degree.

The mouth is abundantly supplied with a watery fluid called *saliva*, particularly during mastication, when it is secreted and poured in in considerable quantities. This fluid is principally secreted by three pairs of glands, the largest of which are the *parotid*, situated at the root of each ear, and from which two ducts on each side convey the fluid and unite in one previous to entering the mouth. The *submaxillary* glands are situated under the jaws, and their ducts terminate in tubular eminences near the frænum or bridle of the tongue. The other salivary glands are the *sublingual*, situated under the tongue; its ducts terminate rather higher up than those last described. Besides these there are other small glands connected with the cheek and the bottom of the mouth, and one peculiar to sheep situated behind the lower jaw, and extending towards the eye, and communicating with the mouth by means of a duct opening near the last molar tooth. There is thus from these various sources an abundant supply of saliva more copious than most animals possess, and which is rendered necessary by the hard and woody nature of the food consumed in a natural state. It has been found that a large supply passes into the stomach independent of mastication, and is there required for softening and macerating the dry food; for deprived of this supply by an experiment, it has been found that the contents of the paunch remained dry.

The mouth is principally filled with the *tongue*, which is muscular in its structure and very flexible, being, indeed, a principal agent in mastication and swallowing. It is larger at the upper part than towards its tip, and is confined posteriorly to the muscles between the branches of the lower jaw, by a sort of fleshy bridle, and above to a singularly-shaped bone called the *os hyoides*. It possesses both the power of feeling and tasting, and for this purpose is well supplied with two classes of nerves, and is covered by both cutis and cuticle. There is a marked distinction in the back part of the mouth between the horse and the sheep and other ruminating animals. In the former the *velum palati*, or soft palate, a fleshy substance attached to the semicircular border of the palatine bones, is sufficiently long to fall down on the back of the tongue, and thus effectually to close the back part of the mouth, except when food is passing, and prevent either the air or food returning through the mouth. Thus a horse can breathe through his nostrils only, and whenever food is

vomited it passes in the same direction. The sheep being a ruminating animal, such a structure would be inapplicable, as it would prevent the food being returned to the mouth; consequently the soft palate is considerably shorter and narrower. It does not reach the tongue, and the diminished extent of the palatine bones, to which it is attached, as before observed, also limits its action.

The *larynx*, the *pharynx*, and the *tongue* are connected together and to the upper jaw-bone, or rather to the bones of the head, by means of a bone called the *os hyoides*, from its resemblance to a spur. The semicircular part of the spur embraces, in a manner, the larynx, whilst the shaft is intimately connected with the root of the tongue. The *os hyoides* has two long appendages, which articulate with the temporal bone. Thus situated and constituted, this bone gives great support to the soft parts connected with it, whilst, at the same time, it freely admits their extensive mobility. In the act of swallowing, therefore, this bone is greatly called into action.

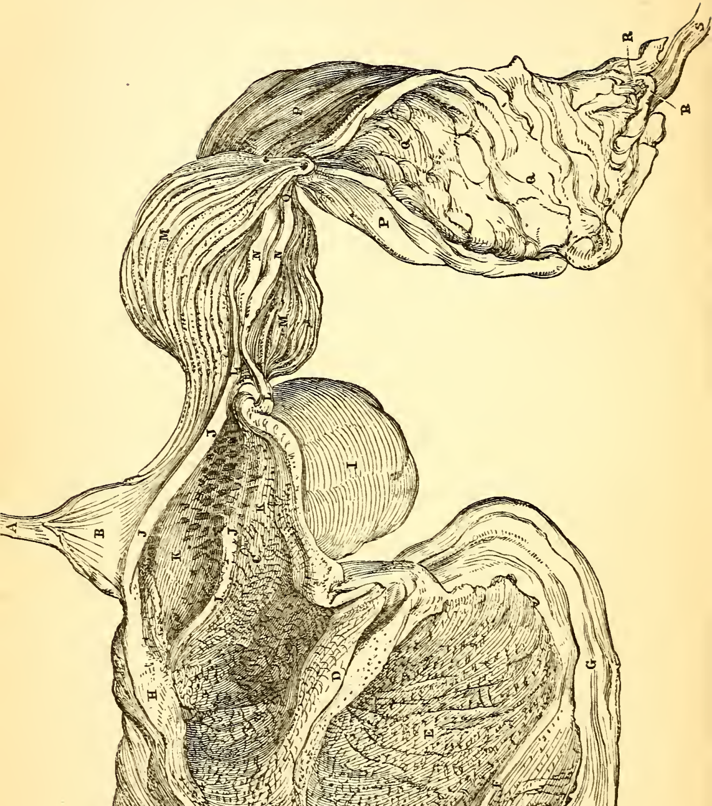
Adjoining the pharynx are two large spaces called the *Eustachian cavities*, situated one on each side, and communicating by means of a tube with the internal ear.

The Organs of Digestion.—The digestive organs of the sheep, like those of graminivorous animals in general, are extensive and complicated, having a far more difficult and elaborate office to perform than those of carnivorous animals. The food of the latter is taken, as it were, ready prepared; its constituents closely resemble those of the blood itself, and of course it is exactly similar to the flesh it is intended to nourish. A small quantity of food only is required to be taken, and nearly the whole of this food is employed in nourishing the system or supplying its waste, the fæces being exceedingly scanty. The digestive organs of herbivorous animals have a much more onerous task to accomplish; the food is in a more crude or less prepared state; the nutritious portions bear a much smaller proportion to the whole mass, and, accordingly, the food taken is of very considerable bulk. To meet these peculiarities the digestive organs are much more spacious and more complicated than those of the carnivora; means are afforded for detaining the food until the nutriment can be properly extracted, a larger amount of chemical and vital force is employed, and a more abundant supply of nervous energy afforded. The horse, in a state of nature, is almost continually feeding; he bites short and well triturates his food, and is almost constantly so engaged; and though, in a domesticated state, the food is not so abundant nor so frequently taken, it is in a much more nutritious form. Corresponding to these

natural habits, we find that, though the alimentary canal altogether is of enormous bulk, the stomach itself is single and of moderate size. Digestion is almost constantly going on; food is passing out of one orifice of the stomach as it comes in at the other, and the supply of bile is constant, there being no reservoir for it—no gall-bladder. The smallness of the stomach is compensated by the prodigious bulk of the large intestines. Thus the horse, though an animal that requries a large quantity of food, is yet able to perform great physical exertions, and can make them after a full meal more readily than any other animal.

The ox, the sheep, and other ruminating animals, have, like the horse, very extensive digestive organs, but very differently arranged. The horse, in a state of nature, will rarely get fat; the ox and the sheep, in good pasture, will almost invariably do so, and will otherwise greatly increase in size; their digestive organs are therefore more bulky than in the horse, and much more complicated, and the intestines are of greater length, though not so large, and instead of one stomach there are no less than four.

The natural food of the sheep is embraced by the joint apposition of the incisor teeth of the under jaw and the cartilaginous pad on the upper, and is separated mainly by the action of the muscles of the head and neck, giving the head an almost constant jerking motion, which may be readily observed when the animal is feeding on pasture. The grass is torn off, not bitten; but when turnips form the food the teeth are more actively employed, and consequently are more worn and become sooner lost. The food being moderately chewed by the molar teeth or grinders, to which it is conveyed by the tongue, is by the same organ carried to the back of the mouth, and being softened by the saliva and thereby mixed with atmospheric air, enters a fleshy bag called the *pharynx* or gullet. This *pharynx* is lined by the same membrane as the mouth, and is surrounded by, and in fact composed of, various muscles, which, by contracting, force the food forwards into a long tube called the *œsophagus*, which leads to the stomach. The *pharynx* is situated immediately above the *larynx* or cartilaginous box which forms the entrance to the windpipe, and the food in entering the gullet passes over the entrance to the larynx, which it is prevented from entering by a triangular lid termed the *epiglottis*, which in the act of swallowing shuts down on the *larynx*, but otherwise leaves it open for the purpose of respiration. The food after leaving the gullet enters the *œsophagus*, a very long tube lined internally by a white insensible membrane, and externally by muscular coats, which, by contracting, force the food onwards to the stomach. The œsophagus passes down the neck



INTERNAL VIEW OF THE STOMACHS.

DESCRIPTION OF THE CUT.

A. The lower part of the *œsophagus*, showing its external coat.
B. Its internal coat at its termination.
C. The upper compartment of the *rumen*, or first stomach, showing its internal coat.
D. The strong muscular band which divides the lower from the upper compartment.
E. The lower compartment of the rumen.
F. Another muscular band.
G G. The external coat of the rumen.
H. The entrance to the rumen cut open, and its opposite part reflected back, so as to exhibit an internal view of the second stomach.
I. The external coat of the *reticulum*, or second stomach.
J J J J. The muscular pillars forming the floor of the *œsophagean canal* when close, but now spread open to show the second stomach.
K K. An internal view of the *reticulum*, or second stomach, showing its peculiar honeycomb structure.
L L. The continuation of the œsophagean canal at the entrance to the third stomach.
M M. An internal view of the *maniplus*, or third stomach, showing its peculiar folds or plaits.
N N. The fleshy lips, which act as valves to guard the entrance between them to the fourth stomach.
O. The termination of the œsophagean canal.
P P. The external coat of the *abomasum*, or fourth stomach.
Q Q. The internal coat of the abomasum, or fourth stomach, showing its folds. Both these coats are displayed by slitting open the stomach and then pinning the duplications together, at its upper part.
R R. The valve formed by puckerings of the internal coat, and guarding the entrance into the small intestines.
S. The internal coat of the small intestines.

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towards its left side and somewhat above the windpipe, with which it enters the chest between the two first ribs; it then takes an upward or ascending course through the cavity of the chest over the base of the heart, passes the midriff or diaphragm, and then descending soon afterwards reaches the stomachs. On entering the chest it somewhat diminishes in size, but again expands in the abdomen. It does not actually terminate in either of the stomachs, but in what is called the *œsophagean canal*, which is about four inches and a half in extent, and is formed above by a continuation of the œsophagus, and below by certain muscular pillars—duplications of the upper portions of the first and second stomachs. Thus the œsophagean canal is a sort of lobby or passage, having entrances to the different stomachs, and which, with the exception of the second and fourth, are the only entrances these stomachs possess. By the annexed cut it will be seen that the food duct commences at the entrance to the rumen, and for the space of three inches its floor consists of muscular pillars or lips, formed by the upper part of the second stomach, the entrance to which is between these lips. The pillars then continue within the cavity of the third stomach for the space of an inch and a half to the entrance of the fourth stomach, the cavity of the third being principally situated above, forming the roof of the œsopha-

gean canal. The entrance, however, to the third commences before the opening into the second stomach ceases. The entrance to the fourth stomach is two inches and a half in extent, and is formed by duplications of the mucous and muscular coats of this viscus, which meet so as to close the entrance when either the will of the animal or the necessity of nature requires.

The usual course of the food is into the *rumen* or *first stomach*, whose entrance is close to the termination of the œsophagus and the entrance of the canal. This stomach is of enormous extent, occupying, indeed, when full, nearly three-fourths of the abdomen. It lies towards the left side extending to the flank, and by a sort of muscular band it is partially divided into two principal compartments. It is lined externally by the peritoneal membrane, in common with the other contents of the abdomen, and internally by an insensible membrane, called the cuticular, between which there are two other coats—the mucous, which secrete the fluid found in the stomach, and the muscular, which is formed of two orders of fibres running in opposite directions. Its interior aspect presents a number of pouches or compartments, which are formed by muscular bands thrown across from one part to another; and the surface presents an innumerable number of papillæ or eminences, not sharp, but blunt-pointed, which are formed by the mucous coat and merely covered by the cuticular. These papillæ are coarser in the lower compartment of the viscus than in the upper. We have said the rumen consists of two compartments, but with greater propriety it may be stated that there are four or five, a smaller one being situated immediately below the termination of the œsophagus and adjoining the second stomach. The use of these partial divisions is very evident. They relieve one portion of the stomach from sustaining the whole of the weight of the food, and they afford steps or resting-places for the food that has undergone maceration, the upper and smaller compartment being that into which the food is raised just previous to being ruminated. The rumen is partly attached to the second stomach, but only communicates with it through the common opening into the œsophagean canal.

The second stomach is called the *reticulum*; its size is considerably less than the rumen, but it possesses much strength in its coats, and its muscular fibres are more developed. It is globular in shape and somewhat larger than the maniplus, and is familiar to us in *tripe*, not only from its cellular structure, but from its being thicker than the others. Its internal aspect is very singular, having a vast number, indeed several hundred, of shallow cells somewhat like a honeycomb. These cells are much smaller

at the part of the viscus nearest the entrance, and gradually increase in size from this point. The sides of these cells consist of ridges formed by the mucous and cuticular coats, and smaller ridges are also observed running across within the cells. Most of them are pentagonal, but many have six sides, and on their surface we observe an immense number of sharp-pointed papillæ much smaller in size though sharper than those of the rumen, and which secrete a mucous fluid. This viscus has the same coats as the rumen, but the muscular coat has two layers of strong fibres arranged both transversely and longitudinally. The opening into this stomach is of some extent, and the duplications or lips which form it are indeed the floor of the greater portion of the œsophagean canal. Though in the ordinary state, the roof or upper part of the reticulum is the floor of the œsophagean canal, yet if air is pumped into the œsophagus so as to distend the stomachs, the situation of the reticulum will become reversed, rising up towards the œsophagus; and thus if this viscus is distended in hoove, as from its free communication with the rumen it probably may be, it must press upon the diaphragm with very considerable force, greater in proportion even than the rumen itself. The contents of this stomach are more liquid than those of the others.

Somewhat before the end of the entrance of the second, the canal terminates, as it were, in the third stomach, the *omasum* or *maniplus*, so called from its curious internal structure, which is formed by a great number of plaits or folds arranged longitudinally in a direction from the entrance of the stomach; so that although it is not large, externally not exceeding the reticulum, its internal surface is increased in more than a tenfold degree. These plaits are very curiously arranged, being in the form of seven or eight groups of six leaves, each leaf dissimilar in length, the longest extending almost from the upper to the lower part of the stomach. These leaves are studded with numerous small papillæ, much harder than those of the reticulum, and some on the edges of the plaits of the shape of a bent cone, thus , the point directed towards the entrance. It has been found in certain cows that would never retain their food, but were continually scouring, that these plaits were unusually short.

The maniplus has but one opening, but this opening is in direct communication with both the canal and the fourth stomach, as may be seen in the sketch, page 108. The plaits are studded with numerous minute papillæ, somewhat similar to those found in the reticulum. The maniplus possesses four coats like the

others, and its external appearance is globular. Its contents are generally found of a much harder consistence than those of the other stomachs.

This stomach, when full, is found above the œsophagean canal, forming, indeed, a portion of its roof, and its longest leaves fall down, as it were, almost into that canal.

The *abomasum,* as the fourth stomach is called, is, in fact, the true stomach, being that which secretes the gastric juice by which the food is converted into chyme. It is this acid juice which gives it the power of coagulating milk, and in calves it is particularly employed for this purpose, under the term rennet, in the manufacture of cheese.

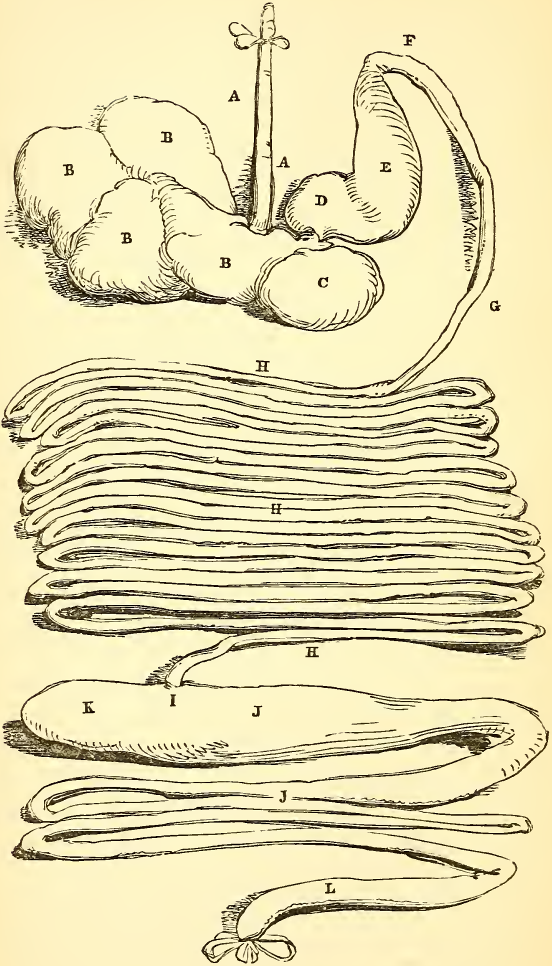
Externally this organ is somewhat conical in shape, its apex being the part which joins the intestines. It possesses three coats, like the other stomachs; but its internal surface is very different, being smooth and shining, and of a pale red colour. Its mucous membrane is, indeed, very vascular, and this secretes the gastric juice. The internal surface is greatly increased, and exceeds the external, by being, in the form of plaits, arranged longitudinally, but very different from those found in the maniplus. The entrance to this stomach (its *cardiac* opening) is close to the entrance to the maniplus: it is arranged somewhat in a crescentic form, and is situated at one extremity of the base, whilst the *pyloric* opening, leading into the small intestines, is, as before observed, situated at the apex. Having thus described the situation and appearance of the stomachs, an external view of which may be seen at page 114, we must return to the consideration of the course of the food through them.

Rumination.—The situation, the structure, and the size of the rumen, point it out as the first and general receptacle for the food, which receives in the mouth only sufficient mastication to enable the animal to swallow it. It is then received by the rumen, and morsel after morsel is taken until the viscus is comparatively full. The animal then feels some repletion, and rumination usually takes place, the animal generally preferring a recumbent posture. It has been shown, however, that it is not the food just taken, but that which has been swallowed some twelve or sixteen hours previously, that undergoes the ruminating process. The food, indeed, is turned and shifted about the stomach by its muscular action, and well mixed with the fluid secreted by its internal surface: it of course enters at first the superior compartment, from which it passes to the inferior, and again enters the former division ere rumination takes place. A tolerably full stomach is necessary for the act; for it has been found in sheep that had fasted for several

days that a tolerable portion of food still remained in the rumen. Before rumination can take place it is evident that the food must rise to the upper part of the viscus and enter the œsophagean canal. What, then, is its direction? The liquid portion passes on in the course of the canal; but it is contended by some physiologists that the second stomach, the reticulum, is the active agent in rumination, and that the food enters it previous to its being returned to the mouth, and they are supported in his opinion by the muscular strength possessed by this viscus. In opposition to this opinion it may be urged that it requires but little more force to raise the food to the root of the œsophagus than to the entrance of the recticulum, and also, that the contents of the second stomach are of a more fluid nature than those of the first. It is not to be supposed that all the food taken is again ruminated; it is chiefly the hard indigestible portion that undergoes the process. Rumination is assisted by the pressure of the abdominal muscles and the diaphragm, and the larger and more distended the stomachs the more likely they are to receive assistance from these aids. Keeping these facts in view, we are inclined to believe that the first stomach has the largest share in the process of rumination. In accordance with this idea we may suppose that a mass of food is raised from the rumen into the œsophagean canal, that the hardest and driest portion is selected by the root of the œsophagus, and that the other part passes onwards, and whilst some portion may reach the third, the great part will fall, as it were, through the trap-door into the second stomach, there to undergo a further macerating or digesting process. When this viscus is moderately full it will contract on its contents, and first squeeze out the fluid portion, which will, of course, pass onwards into the third and fourth stomachs, whilst the solid part will be embraced by the œsophagus and returned to the mouth.

It is evident that the functions of the œsophagus are much more onerous than in non-ruminating animals, and accordingly it is furnished with more muscular power; the lower portion particularly is surrounded with spiral muscles, by which the selected pellet is first sent upwards.

It is not unlikely that some portion of the food may be submitted two or more times to the process of rumination. It is probable that the most liquid portion of the food at once enters the fourth stomach, and that of a harder nature the maniplus. The singular construction of this viscus evidently shows that it must effect an important office, and it has been found that in animals which through life have never thriven well, notwithstanding that they have consumed a larger quantity of food than other beasts,



EXTERNAL VIEW OF THE STOMACHS AND INTESTINES,

Spread apart and arranged according to the following scale, so as to show their actual and relative size.

Scale. 1 foot.

DESCRIPTION OF THE CUT.

A A. The *œsophagus.*
B B B B. The *rumen*, or first stomach, showing its compartments.
C. The *reticulum*, or second stomach.
D. The *maniplus*, or third stomach.
E. The *abomasum*, or fourth or true stomach.
F. The commencement of the small intestines at the pyloric orifice of the stomach.
G. The situation where the biliary duct empties its contents into the duodenum.
H H H. The small intestines freed from the mesentery, and arranged evenly, so as to show their length.
I. The termination of the small and beginning of the large intestines, guarded by a valve.
J J. The *colon*, or first large intestine.
K. The blind extremity of the colon, by some termed the *cæcum.*
L. The *rectum*, or straight gut.

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the maniplus has been imperfectly formed, the plaits being short, so as to afford considerably less surface than usual. The use of this stomach, therefore, is to detain the food, to press it between its fifty folds, and to soften it by the secretion afforded by its extensive surface, and thus to prepare it for the action of the gastric juice in the fourth stomach, to which organ we now trace it.

In the young animal living entirely on its mother's milk, the fourth is the only stomach employed; it is, therefore, then fully developed, whilst the others are small and imperfectly formed. The milk contains the elements of nutrition in a much more perfect state than it exists in vegetable food. It requires but a little separation in order to fit it for nutrition. As the young animal gradually becomes inured to other food, the other stomachs become more developed. By the time the food reaches the *abomasum* it is in a macerated pulpy state, and fit to be exposed to the powerful solvent action of the gastric juice. This fluid is secreted in abundance by the mucous coat of the fourth stomach. It is a peculiar fluid, acid in its nature, and so powerful a solvent that it has been known after death to dissolve a portion of the coats of the stomach itself. It has in its composition hydrochloric acid as well as acetic, and its action on the food is of a chemical nature, converting it into *chyme* and rendering it fit for the other digestive processes. The food being thus dissolved, passes through the pyloric opening into the small intestines; this orifice has a valve-like construction (see p. 108), admitting the food to pass in one direction only, and then not until it has been sufficiently acted on by the gastric juice.

The small intestines are of considerable length in the sheep, being upwards of sixty feet. In the human subject it is customary to divide them into three portions, and they are called the *duo-*

denum, the *jejunum*, and the *ileum*. These distinctions are arbitrary even in man, but still more so in the sheep, and, in fact, cannot be properly applied. The first portion of these intestines (the duodenum in man) differs much from the rest. It lies comparatively loose, and on opening it we observe a yellow substance, which is, in fact, the bile, which enters by a duct or very small tube some eighteen inches from the stomach, and at nearly the same place another fluid flows in from the pancreas or sweetbread. These fluids, it may be supposed, exercise an important office in the process of digestion, and the early portion of the small guts is the situation where the admixture takes place.

The LIVER is a bulky organ whose size, general appearance, and shape must be familiar to most people. Its weight in sheep is about one-fiftieth that of the carcass, and its specific gravity is somewhat greater than water. It is partially separated into divisions or lobes, and is principally situated towards the right side. Its office is to separate the bile from the venous blood—that which has circulated through a great portion of the body and is on its way to the lungs to be re-purified. It is called a gland, and is, in fact, a fine sieve or filter, having the power of separating a peculiar substance from the blood and no other. It is supplied with arterial blood for its own nourishment, but by means of a large vein called the *vena porta* it is furnished with venous blood for the exercise of its functions. The bile being thus separated is then conveyed into a reservoir attached to the liver and called the gall-bladder, from which the gall-duct rises, and enters the intestine about eighteen inches from the stomach. Ruminating animals, in common with man and the carnivora, are furnished with a gall-bladder, whilst horses and the other solidungulous animals do not possess them; the reason being that in the latter the digestive process is continually going on, and therefore a constant supply of bile is essential, while in the former the food is either taken in distinct meals, as in man and the carnivora, or otherwise the ruminating process is carried on and renewed at different periods, as in sheep and cattle—in either case requiring large and copious supplies of bile to complete the process of digestion. It must be evident, from the existence of the gall-bladder in some species of animals and its absence in others, that the bile must perform an important part in the digestive process. One of its functions is to neutralize the acidity which the food or *chyme* has acquired in the stomach by means of the gastric juice, and thus prepare it for the separation of the chyle which may be seen on the surface of the food. For this purpose it is largely supplied with an alkaline fluid, which unites chemically with the acid of the chyme. The

quantity of bile secreted by the sheep in twenty-four hours is very considerable, probably from 3 lbs. to 5 lbs.; but we are not to suppose that its sole use is that above stated, for it has been proved that the bile does not pass away with the excrements, but is again taken into the system to supply nutriment to the body and perform other important offices. Thus the liver separates that which would be detrimental to the blood, and it supplies what is wanted for digestion as well as for another important process in respiration.

It is observed by Professor Simonds that the liver is an assimilatory and secretory organ, as well as an excretory one, in all of which offices it plays an important part in the manufacture and purification of the blood. The vessel by which it receives blood for the secretion of bile—the portal vein—takes its origin from the capillaries of the chylo-poietic viscera; and the nutritive materials of the food, apart from the chyle, which enter these vessels from the intestinal canal, are consequently not conveyed at once into the general circulation, but first subjected to the action of the liver. 'The blood in the portal vein differs materially from venous blood in other parts of the body. Among other things, it is deficient in fibrine and albumen, but contains more red corpuscles and about twice as much fatty matter; and in animals fed on farinaceous substances, more sugar.' (Kirkes.) 'And as, after having passed through the liver, the fibrine is increased, and other no less important changes wrought in the blood, there seems no reason to doubt that this fluid has been both deprived of materials which would be injurious to it and assimilated more to the character of ordinary blood. Apart from this, fatty matters especially would appear to be elaborated within the gland, either from saccharine substances or from albuminous compounds; for even when no fat can be detected in the blood of the vena portæ, that of the hepatic vein contains it in considerable amount.' (Carpenter.) In the recent experiments also of Dr. Harley and Professor Sharpley, communicated to the Royal Society, it has been shown that even when the portal blood is devoid of sugar, as in a fasting animal or one fed solely on flesh, sugar is found in the liver, having been formed therein. The bile, as may be easily supposed from the foregoing premises, is a very complex fluid, and has a more important office to perform in the assimilation of food than in the carrying away of materials which impair the blood. Entering the duodenum by means of the main biliary duct, it commences with the digested food as this passes from the stomach; and, assisted by the fluid secreted by the pancreas, which is also present in the intestines, effects the chylification of the chyme. The

chyle thus formed is absorbed by the lacteals, and carried by them into the general circulation. In the process of chylification a portion of the bile—the colouring matter in particular—as excrementitious material is moved onwards with the unassimilated parts of the chymous mass and ejected as fæculent matter. That portion of the fluid, however, which is employed in effecting chylification among other things, acts on the starch of the food and converts it into sugar, ready to be taken up by capillary blood-vessels.

The presence of bile in the intestines is also said to cause a more free absorption in augmented quantities of the fatty matter of the chyme. The liver may thus be regarded as the great regulator of the amount of sugar and fatty matter in the blood, any excess of which, not required to support animal heat, accumulates in the various tissues of the body. If this be so, the more active the secretory function of the liver, the greater the amount of sugar and fat which will be absorbed from the food.

Besides the bile, the *duodenum* receives a copious supply of fluid of a thin watery nature from the pancreas. This fluid closely resembles the saliva, and its principal use appears to be to liquefy the contents of the intestines.

The remaining part of the small intestines understood under the terms *jejunum* and *ileum* are confined to, and connected with, the spine by means of a thin transparent membrane called the mesentery, which not only supports the intestines, but prevents their entanglement, and serves as the vehicle by means of which the arteries, veins, nerves, and absorbent vessels are transmitted to and from the bowels. Amongst these there are some very minute, though very numerous vessels, called the lacteals, whose office it is to convey the chyle, a white milky liquid resembling albumen, from the intestines to a duct termed the *thoracic*, which passes along the spine and terminates in a large vein just previous to its arrival at the heart.

The composition of the chyle is very similar to the blood, differing from it in little more than the absence of its colouring principles. The lacteals, of course, open into the inner coat of the intestines, and the greater portion of the chyle is taken from the food in the small intestines, and in the earliest portion of them in the greatest degree. The small intestines are remarkably long in the sheep, exceeding, indeed, sixty feet, and this great length renders them capable of containing much more than the large guts.

In man, the large intestines are distinguished as the *cæcum*,

the *colon*, and the *rectum*; in the horse, these divisions likewise obtain, and with much more propriety than the artificial distinctions of the small guts. The cæcum and the colon in the horse commence almost close to each other, but the former is a blind gut, having but one entrance. The sheep, however, can scarcely be said to possess a cæcum, unless we term the blind portion of the colon by that name; for the fact is, the small intestines terminate in the large at a right angle with them (see I. in cut p. 114), and the blind portion extends about a foot in one direction from this angle and maintains its size for the space of two feet.

The termination of the small intestines in the large deserves particular notice. The internal membrane of the former projects into the latter so as to form a sort of valve, which, admitting the fæces to pass forwards, effectually prevents their passing backwards, and thus, too, prevents the effects of clysters operating beyond the large intestines. The diameter of the colon is about treble that of the small intestines, but this increased size only reaches the extent of three feet, when the intestine gradually diminishes to about the size of the small guts, and so continues for about nine feet, when it enlarges about a foot prior to its termination. This latter portion may be termed the rectum without impropriety. Soon after the large intestines become narrow, the fæces gradually become hard, and acquire the form of small black balls, in which state they are dropped.

The chyle, we have observed, is principally absorbed from that portion of the small intestines termed the ileum; there is little or none remaining by the time the fæces reach the large intestines, but the fluid absorbed from these guts is principally of a watery nature.

The Urinary and Generative Organs.—The urine is separated from the arterial blood by means of the *kidneys*, which are two large glands shaped like a bean, situated within the abdomen, but attached firmly to the loins. These glands are largely supplied with blood by important arteries; and the urine being separated as by a filter, enters two long white ducts termed the *ureters*, one of which rises from the pelvis or central notch of each kidney, and passes on to the bladder, whose coats are pierced in an oblique direction not very far from its extremity or fundus,* and forming a sort of valve, prevents the urine returning.

* The urine of the sheep is much less copious than that of the cow, and, though less abounding in substances containing nitrogen, possesses a larger

The *bladder* is situated partly in the pelvis and partly in the abdomen, the latter portion being comparatively free, whilst the former is closely attached to the pelvis. The shape of the bladder is too well known to need description. It becomes smaller as it approaches its posterior part, where it contracts and forms the neck just prior to its opening into a canal called the urethra. The bladder, although apparently so thin, yet has three coats, the middle one of which is muscular and possesses the power of contracting so as to expel the whole of its contents when required, and the opening is usually kept closed by a sphincter or circular muscle, which relaxes when the bladder is being emptied. The urethra in the ewe is very short, a few inches only in length, and it is guarded by muscles which are employed both in expelling the urine and in the act of procreation.

In the ram the urethra is of considerably greater length, extending the whole length of the penis; it forms an acute angle at the perineum, just under the anus. The *penis* is a muscular organ, having a very curious structure, which enables it to receive at times an increased quantity of blood, which fits it for its purpose. Its usual state, however, is flaccid, when its use is confined to the ejection of the urine.

The *vagina* and *uterus* or womb lies between the rectum above and the bladder below, and though much within the pelvis in the ordinary state, yet in pregnancy the uterus rises into the abdomen to a great extent. The vagina, which commences a few inches within the body, is a cylindrical cavity several inches in length, and communicates with the uterus by a round opening called the mouth of the womb, which is naturally open, but becomes closed after impregnation. The womb consists of a body and two branches or horns. It has the same number of coats as the bladder, but they are much stouter, and more so than those of the

proportion of salts. The following is an analysis of 100·000 parts by weight:—

Water	96·000
Urea, along with some albumen and colouring matter	2·800
Salts of potash, soda, lime and magnesia, with traces of silica, alumina, iron, and manganese . . .	1·200
	100·000

This gives 4 per cent. more water than the urine of cows, than which it is less fertilising to the soil; but the dung of sheep is much more nutritious than that of cows, and the urine likewise, when dropped on pasture land, is more serviceable, in consequence of the small quantity deposited at a time, and the less proportion of caustic ammonia contained, so that it does not render the herbage rank, as is the well-known effect of the fresh urine from cows.

vagina. Attached to the extremity of each horn by a membranous substance are two red bodies called the ovaries, each of which consists of a number of ova or eggs, the germs of the offspring, one of which bursts its envelopment from time to time under the influence of the œstrum, escapes into the uterus, and on being impregnated by the male in the course of time becomes a young animal; sometimes, indeed, two or even three ova may be impregnated, and twins or triplets are produced.

The *testicles* are two oval glands contained in the scrotum, a sort of bag formed by the skin and two membranes within, which are so disposed as to form two separate cavities, each containing a testicle. The testicles are first formed in the abdomen of the fœtus, and each possesses a covering closely attached to the gland. They escape from the abdomen through the openings called the abdominal rings and take with them portions of the peritoneum, the membrane which lines the abdomen and its contents; thus it is that they possess two coats besides the skin. The abdominal rings remain open afterwards, contrary to what takes place in the human subject, so that a fluid can be injected from the scrotum into the abdomen, and thus it is that sometimes after the operation of castration inflammation takes place and spreads upwards into the belly and destroys the lamb. In those cases where portions of the intestines are found in the scrotum they escape from the abdomen together with the testicle, and the case is denominated congenital hernia. The testicles are also connected with the belly by means of the spermatic cord, which is composed of a long slender muscle also nerves, veins, arteries, and a strong hollow tube called the spermatic duct. It is the latter which conveys the seminal fluid secreted by the singular structure of the testicle into the urethra, where, with other secretions from some small glands, it is forcibly ejected when required.

The testicles are very large in proportion to the size of the animal, and are in keeping with the powerful seminal powers possessed by the ram, and which enable him when full grown to serve properly eighty to one hundred ewes in the course of a month.

THE CONTENTS OF THE CHEST.

The *mouth* in the horse is almost entirely devoted to the office of mastication. It is separated from the cavity of the nostrils by a loose fleshy membrane called the *velum palati*, which is confined to the bone above by a semicircular border, and falls downwards and backwards so as to prevent, in a natural state, any

communication between the windpipe and the mouth. The sheep likewise possesses this *velum palati*, but it is not so long, and therefore permits this animal to respire through the mouth as well as the nostrils. The importance of this construction is seen in the process of rumination, and also accounts for the horse vomiting through the nostrils, on those few occasions when this animal has been known to vomit. The nostrils, however, are the principal channel through which the air passes to and from the lungs. Their entrance is comparatively small and confined; the sheep does not require so extensive a supply of air as other animals that are called upon to make considerable exertions. The cavity of the nostrils is divided into two compartments by a thick cartilaginous substance, termed by anatomists the *septum nasi*, fixed to the nasal in front, and behind to the maxillary bones. This cartilage, as well as the other parts of the nostrils, is lined by a fine delicate membrane which secretes a mucus for its protection. It is indeed an inflammation of this membrane which constitutes a catarrh or cold, and an increase of its natural mucous secretion is the discharge from the nose which is visible in this disease. This membrane is called the *Schneiderian*, from the name of its discoverer, as well as the *pituitary*, and it is endowed with a high degree of sensibility, which it derives from an abundant supply of sensitive nerves; it is also the principal seat of the sense of smelling, and for this purpose the nerve devoted to this function is spread out on its surface. This membrane also covers four curious bones, thin and gauze-like in their structure, and being rolled up like a turban, are termed turbinated, and are attached to the chambers of the nostrils. These greatly extend the surface on which the nerve of smell is diffused, and consequently increases the function of this sense, which sheep enjoy in a very high degree. The nostrils at the upper and back part terminate in a cartilaginous box called the *larynx*, which is situated immediately beneath the pharynx or food-bag; so that food, in passing into the latter, traverses the entrance of the former, which, however, it is prevented from entering by a triangular lid called the *epiglottis*: this lid in its usual state is elevated from the glottis or entrance of the larynx, so as to admit the free entrance and exit of the air, but the passage of food forces it down so as to close the entrance of the windpipe. The *larynx* is formed by four separate cartilages besides the epiglottis just spoken of. One is shaped like a shield, and forms the front of the larynx and a portion of its sides. Another below this is circular; and two other smaller ones, shaped like an ewer, form the rims on which the epiglottis shuts down. The larynx is lined throughout by a mucous membrane, which is

endowed with a high degree of sensibility, particularly at its upper portion; and thus when any foreign body accidentally enters, or the mucus is in undue quantity, it excites the membrane, and coughing is produced, by which it is expelled. The *windpipe* consists of a number of cartilaginous rings connected together by elastic membrane so as to form a continuous tube passing down the front part of the neck and entering the chest between the two first ribs. The rings are not completely cartilaginous, but the circle is made up of membrane, the membranous part being on the upper portion of the tube. This structure permits the windpipe to be bent in any direction or compressed without injury, its elasticity quickly restoring it to its former shape or position. The windpipe, on entering the chest, divides into two portions, one going to each division of the lungs; and these subdivide into others, which again ramify into numerous small tubes, which ultimately terminate in the very minute air-cells of the lungs.

The *chest* of the sheep, in common with most quadrupeds, is unlike that of the human body, becoming narrow towards the lower part and terminating like the keel of a ship—a form more favourable to the flexion and extension of the fore-legs, as well as of the shoulder-blades, than any other. This keel-like form is, however, much less developed in the sheep than in the horse and many other quadrupeds. The upper part of the chest is formed by the spine or back-bone, the sides by the ribs, and the front and lower part by the sternum or breast-bone. The number of ribs varies in different animals; in man there are twelve, in the horse eighteen, but in the sheep there are only thirteen pair. Each rib possesses two heads or protuberances, each of which is connected by a joint with two vertebræ or bones of the back, and to the breast-bone by means of cartilage. The sternum or breast-bone, in young animals, is chiefly cartilaginous, and may be separated into eight pieces; it afterwards becomes divisible into four only, and with age is consolidated into one. The ribs are externally convex, and are divided into the true and false; the former being situated anterior to the others, and immediately connected with the sternum, whilst the latter are implanted into each other at their cartilaginous extremities, and are only connected with the breast-bone by means of the true ribs. Their connexion with the spine, by means of a double joint, affords to the ribs a motion backwards and forwards, by which means the cavity of the chest is enlarged or diminished. This motion, however, is considerably less in quadrupeds than in man, for in the latter the rising and falling of the chest is seen in common respiration, whilst in the former it is not perceived, unless the breathing

be embarrassed. The ribs are connected together by fleshy substance, termed the intercostal muscles, which are disposed in an oblique course, by which means their length considerably exceeds that of the space between one rib and another, so that a contraction of one-third their length will bring the ribs together, which could not be the case if the muscles took the shortest course from one rib to another.

The chest is separated from the abdomen or belly by a very singular and important muscle, called the *diaphragm* or midriff, which is convex towards the chest when in a state of rest. This muscle is shaped somewhat like a fan, and is attached to the inferior extremities of the ribs and the spine, by which means its position is rendered oblique, its development more extended, and its action greater than it would otherwise have been. The diaphragm, unlike every other muscle, is fleshy at its circumference and tendinous at its centre. The reason for this peculiar construction may be thus explained:—The central part of the diaphragm is pierced with two holes for the passage of the œsophagus (the tube which conveys food to the stomach) and the vein which conveys the blood to the liver for the secretion of bile. Now, if these important vessels were surrounded with muscular substance, they would be forcibly compressed every time the diaphragm contracted, and would in consequence be exposed to considerable injury; but being surrounded with tendinous substance, which possesses no such power of contraction, all danger of compression is at once removed, without any sacrifice of strength or power in the muscle. The diaphragm, when in a quiescent state, is convex towards the chest, and when in action becomes flat, thus enlarging the cavity of the chest.

The *thorax* is everywhere lined internally by a thin serous membrane, which secretes a fluid by which the surface of the cavity is lubricated, and its contents are enabled to glide upon each other without occasioning any friction or inconvenience. This membrane is called the *pleura*, and the portion which lines the chest itself is designated the *pleura costalis*, while that which covers the lungs is distinguished as the *pleura pulmonalis*. This membrane divides the chest into three cavities, one on the right containing the *right* lung, and the other two on the left side, the smaller of which contains the *heart* and the larger the *left* lung.

The *right* lung is thus the largest, and consists of three lobes or divisions, whilst the *left* lung only contains two. These divisions of the chest do not communicate with each other, so that if one cavity is injured, or air is admitted into it, respiration can be carried on in the other.

The *lungs* are light spongy bodies, their specific gravity being one-half less than water. They are composed of the air-cells before spoken of, the bronchial tubes connected with them, and a vast number of arteries, veins, and absorbent vessels, the whole being connected together by cellular substance, or *parenchyma*, as it is termed: thus constituted, the lungs are closely packed away in the cavity of the chest, filling every part of it, so as to leave no vacant space whatever.

The Blood and its Circulation.—The blood is by far the most important fluid in the animal machine; it stimulates the heart to contract, secretes and nourishes the various organs of the body, and supplies it with heat; and although it is the source whence other fluids are obtained, it is yet a fluid *sui generis*, differing from all others. Soon after it is drawn from the body it coagulates, and then separates into two parts; the *serum*, a watery, colourless fluid, which floats on the top, and the *crassamentum*, which appears of a firm consistency and a red colour. The serum is a peculiar fluid, and may be separated into its constituent principles. If subjected to a temperature of 150°, a portion is converted into a substance resembling albumen or the white of an egg; the other portion remains fluid and is termed the *serosity* of the blood, and is that which constitutes the gravy in meat. The serum contains several salts in solution, the most abundant of which is soda. The crassamentum is likewise divisible into two portions: the cruor, which gives to the blood its purple hue; and the lymph, which is more solid in its nature, and is considered the basis of the coagulum. The latter can be separated from the former by washing, and likewise separates when the blood is a long time coagulating, in which case the red portion of the blood, being the heaviest, falls to the bottom of the vessel, leaving the lymph on the top. The cruor, or red portion of the blood, has been found, on being submitted to a microscope, to be composed of globules, which are supposed to be each about the three or four thousandth part of an inch in diameter. It is therefore to these globules that the blood owes its redness; but the intensity of the colour is subject to great variation, being darker in animals that are poorly fed, or when exposed to carbonic acid, and becoming more florid in others that are well fed, and also when exposed to oxygen, or to atmospheric air.

The other part of the crassamentum, the lymph, which from its nature is also called the *fibrine*, is, in fact, the most important of all; for it is that which mainly supplies the different parts of the body, particularly the muscles, with nutriment, and repairs wounds and fractures in an extraordinary manner. Unlike the

cruor, it exists in the blood of all animals, and in every part of the system. Some animals have entirely white blood, the cruor being absent; and in red-blooded animals there are some portions of the body, such as the white of the eye, where the vessels are so small that they do not admit the red globules. The specific gravity of blood rather exceeds that of water; but venous blood is somewhat heavier than arterial. The temperature of the blood varies in different animals; in man it is 90°, but in the sheep nearly 100°. It is rather warmer in the arteries than in the veins, and is liable to variation from disease, it having been found in severe inflammations to be raised 7° in man, and in the cold fit of agues to be 4° lower than in a state of health. It is, however, but slightly raised or depressed by external temperature. It was not till comparatively a recent date that the blood has been considered to possess vitality, which, however, is now generally acknowledged. The vitality and fluidity of the blood are intimately associated; in fact, its coagulation, when removed from the body, constitutes its death. The time which this is in taking place is different in different animals, and is influenced by various circumstances. In strong frames, such as the horse, it is longer than in such weak animals as the sheep; in the former it is often as long as fifteen minutes; and if the body is in a state of plethora, the vital power being too highly developed, the death of the blood is much longer resisted. In these cases coagulation is delayed, and in consequence the red portion of the blood, being the heaviest, falls to the bottom of the vessel, and the fibrine remains at the top, constituting the buffy coat of inflammation. This separation, when arising from the above cause, takes place long before the serum is seen. The coagulation of the blood has been endeavoured to be accounted for without success; it was held by some that it was produced by the cessation of its motion; but it has been found that if stirred in a vessel it will coagulate quicker than before. It was thought that exposure to the atmosphere was the cause; but it has been known to coagulate in a vacuum, and likewise in the body when a vein has been tied. It was next conceived that it was caused by the low temperature to which it is exposed; but it has been ascertained that it will coagulate quicker if the temperature is either higher or lower than natural; but if so low as to freeze the blood, it will not coagulate when afterwards thawed. These experiments show that the blood is analogous to no other fluid, and that coagulation cannot be owing to physical causes, but can be explained only by reference to its vitality.

Although the blood will coagulate in the body if obstructed, yet there is a considerable difference between this state and its

coagulation out of the body. In the former instance coagulation is longer occurring, new vessels are thrown into its substance, and it becomes organised. So, likewise, if a part be wounded, the divided vessels throw out clots of blood, which adhere to the surface of the wound; the red particles become absorbed, the glutinous fibrine organised, and the breach is thus gradually restored. Thus we see how important it is that the blood should possess its peculiar properties, its state of fluidity, and its disposition to coagulate: if the former did not exist, the blood would be obstructed in the capillary vessels, and the vital functions could not be carried on; and if deprived of its coagulating property, no wounds could heal, or loss of substance be restored, but the most trifling cut would be the precursor of death.

The quantity of blood contained in the body is very difficult to ascertain; for if an animal is bled to death, a good deal will still remain in the blood-vessels. It has, however, been estimated to be about one-fifth the weight of the body; and of this, about three-fourths are contained in the veins, and one-fourth in the arteries. In young animals there is more than in old ones, as in them the body must not only be sustained, but increased in size. It is likewise more abundant in wild animals than in tame ones, and in proportion to the vigour of the animal.

The *Heart* is a strong hollow muscle, of a conical shape, with its base towards the spine, and its apex leaning to the left side, against which it is thrown at every contraction. It is double, having a right and left side, the former containing black, and the latter red blood; the right side is the thinnest and weakest, being devoted to the lesser office of the circulation of the lungs; the left the stoutest, having to govern the general circulation of the system. Each of these halves consists of two cavities, an auricle and a ventricle; the former, which derives its name from its resemblance to a dog's ear, is considerably thinner than the latter, and is situated towards the base. The heart is formed principally of fleshy fibres, connected together by cellular tissue, whence it obtains its elasticity; and its surfaces, both internal and external, are lined by a transparent membrane. The blood is prevented from moving in a retrograde course by means of a number of valves; there are three in the left ventricle, the edges of which are connected by tendinous cords (*cordæ tendinæ*) to small fleshy eminences on the inside of the ventricle, called *carneæ columnæ*, or fleshy columns. These tendinous cords are more numerous in the valves of the left ventricle than in the other parts, and being supposed, with the valves, to resemble a mitre, are named mitral valves. There are valves also in the right ventricle for similar

purposes, which are named tricuspid, or three pointed; also in the great artery, or aorta, and in the pulmonary artery, where, having no cords, and resembling in shape a half-moon, they are named semilunar. The heart is enclosed in a strong membranous bag, which is named *pericardium*, and this encloses also the trunks of the veins and arteries, as well as the appendages or auricles.

The heart is a muscle, but, unlike other muscles, it is involuntary, being altogether independent of the will, and is for this purpose supplied by a peculiar set of nerves. It is also furnished abundantly with blood for its support, by means of arteries which are the first that are given off; and these arteries are accompanied by veins for the return of the blood to its proper receptacle.

The Circulation of the Blood is one of the most important processes in the animal economy; when suspended for a few moments, a state of insensibility is produced, and if this suspension continues a little longer, death quickly supervenes.

The heart, we have seen, consists of two halves or sides, the right being devoted to the pulmonary circulation. The *right auricle* receives from a large vein, called the *vena cava*, the blood which has travelled throughout the system; whence it passes, by the action of the heart, into the right ventricle, which by its contraction forces it into a large vessel called the pulmonary artery. Thence the blood is sent into the lungs and ramifies throughout its minute vessels, where it is exposed to the action of the inspired air, and becomes, by means we shall afterwards speak of, reddened and purified. This process being accomplished, the blood passes into minute vessels, which coalescing, become the pulmonary veins, and through them the blood again returns to the heart; thus finishing the circuit of the pulmonary circulation.

The *left auricle* receives the purified blood from the pulmonary veins, forces it into the left ventricle, which, contracting, sends the vital fluid into a large strong vessel called the aorta, whence it enters smaller arteries, to be distributed throughout the whole system. The remote divisions of the arteries are called the capillary vessels, and in them the blood, after having accomplished its purposes and conveyed nourishment to all parts, becomes black and impure, and in this state enters the capillary veins, which, conjoining and increasing in size and diminishing in number, convey the blood again to the right auricle of the heart. Just before it enters the heart it receives a supply of chyle, which, as we have before observed, is extracted from the food, absorbed by certain small vessels called lacteals, and conveyed by a specific channel to the heart. Such, then, is the circle, or rather the

double circle, which the blood takes, and by which so many important purposes are beautifully and correctly accomplished.

The circulation of the blood is accomplished by the joint action of the heart and arteries, but principally by that of the former. The contraction of the ventricles and of the auricles immediately succeed each other: as the one expands to receive the blood, the other contracts to force it forward, thus producing the unequal double action of the heart that we feel. These actions, however, of the different cavities could not be correctly performed unless some provision were made for preventing the blood, when the ventricles contract, from retrograding into the auricles. This, however, is effected by means of a valve, situated between these cavities, which is formed by a duplication of the inner membrane of the heart, thickened by fibrous substance. The floating edges of this valve in the right ventricle present three points and in the left two; whence the former is called the tricuspid, and the latter the mitral. The edges of each valve are joined by numerous short tendons to the fleshy columns of the heart; and whilst the blood is flowing into the ventricles the fleshy columns are passive; but when the ventricles act, these columns also contract and draw the edges of the valve together, and thus close the cavity in that direction and prevent the blood re-entering the auricle.

There are also valves that guard the entrance of the aorta and pulmonary arteries, but they are of a different description, being of less strength, because they are not called upon to oppose the powerful action of the ventricles. Accordingly we find they consist of three folds of membrane, and are called, from their shape, semilunar. They are so situated that when the blood passes into the arteries they are thrown against their sides, and when the blood has passed they are thrown up so that their edges meet, and thus prevent the blood returning to the heart.

In fishes the heart is single, and only serves the office of the pulmonary circulation, that of the system being accomplished by the arteries alone. In the sheep, though the heart is the principal power, yet the arteries greatly assist. The aorta, which receives the blood from the left ventricle, divides into two branches, called the anterior and posterior aorta; the former conveying the blood to the head and neck, and the latter to the lower parts of the body. These arteries are strong and thick, and consist of three coats; the outer, the strongest and thickest, gives the vessels the remarkable elasticity which they possess; the middle coat is the fibrous, which seems to be a modification of muscular

power, and enables the arteries to contract on their contents; the third coat is the serous, which lubricates the interior of the vessel and facilitates the passage of the blood. Thus to these several coats, but particularly to the two former, do the arteries owe the remarkable property they possess of contracting when distended with blood, and almost immediately afterwards expanding to receive a fresh supply, and which, assisted by the action of the heart, constitutes the pulse; and may be felt in every part of the body where an artery is sufficiently near the surface to be perceptible.

The arteries, however, do not all possess an equal thickness and power; for instance, the pulmonary artery, though quite as large as the aorta, is neither so thick nor so strong; and the reason is, that the same power is not required to send the blood over the smaller circuit of the lungs as over the larger one of the whole system; and, for the same reason, the right side of the heart is weaker than the left. The arteries, as they divide and subdivide in their course, become weaker in their coats in proportion to the diminution of their size, till at length they terminate in the minute branches called the capillary vessels, which do not possess any pulsating power, and many of which do not contain red blood. Diminutive, however, as these branches may be, yet it is by them that the most important offices are performed; by them the different parts of the body are nourished, whether bone, flesh, nerve, or skin; by them the various fluids are secreted, however different in appearance they may be; by them the most ghastly wounds are healed, and often in a remarkably short space of time; and all these various offices are performed, not only by the same class of vessels, but by the same fluid, the blood. Having accomplished these important purposes the capillary arteries terminate in equally minute vessels, called the capillary veins; and so abundant are these diminutive vessels that the finest point of the finest needle cannot be plunged into the body without penetrating some of them. By the time the blood reaches the veins it becomes dark and impure, and loaded with carbon: the office of the veins, therefore, is to return it to the heart to be again purified. The circulation, however, becomes much slower as it is further removed from the impulsive power of the heart, and the veins, which are supposed to contain two-thirds of the whole blood circulating in the system, are consequently much more numerous than the arteries: they do not, however, possess the same strength in their coats as the arteries, nor have they any pulsating power. They have, however, the assistance of other agents in propelling the blood to its destination. The greater

number of them possess valves, which admit the blood to pass in one direction, but effectually prevent its passing in any other. It was, indeed, from reflecting on the structure and necessary office of these valves that led the immortal Harvey to discover the circulation of the blood. Another circumstance peculiar to the veins is their situation, being mostly near the surface of the body, whilst the arteries are generally deep seated. The wisdom of this provision is evident: it is well known that in wounds it is readily ascertained if an artery be wounded by the jet of blood that ensues, and which even from an artery of small size is very considerable, and the danger of death from bleeding is often great in consequence of the force with which the blood is thrown into these vessels. Now such being the danger attending the division of arteries, it was necessary to remove them as much as possible from the risk of injury, and accordingly they are almost invariably deep seated, and when they do approach the surface it is in parts least likely to be injured. Thus round these important vessels nature throws a thick muscular covering, and protects the whole by a mantle so sensitive as to give warning to the least attack. The veins, however, do not require this care; in them the circulation is languid, and their wounds are comparatively unimportant and unattended with danger, for the blood generally stops, without assistance, from its coagulating quality. It is also of importance that the greater portion of the veins should be situated near the surface, in order to receive the influence of the atmospheric pressure, which greatly assists the motion of the blood; and it has also been found that the veins possess a power of absorption in common with a particular order of vessels called the absorbents; thus these various purposes are effected by the relative position of the veins and arteries. The structure of the veins is very different from that of the arteries; for, whilst the latter are thick, elastic, and composed of three coats, the former are thin, inelastic, and composed only of two coverings. But although thin, they are yet capable of affording great resistance to pressure.

We have seen that the blood is sent to all parts of the body by the action of the heart and arteries, but what is the cause of its return? First in importance is the law of hydrostatics, 'that all fluids support their level.' Thus the same law by which springs arise, and streams are produced, and rivers flow towards the sea, is brought to bear in the living system, and enables the blood in the arteries to support that in the veins. This effect is greatly assisted by the action of the valves in supporting the column of blood. The blood thus supported and propelled by

the arteries, assisted by atmospheric pressure, must go somewhere, as the valves prevent return; it goes, therefore, where alone a vacancy is afforded, and that is in the right auricle of the heart, which has just propelled its contents into the ventricle. To these several forces may be added a power of suction the heart possesses whenever the chest is enlarged in respiration.

The manner in which the chyle is mixed up with the blood, so that its colour quickly disappears, is worthy of particular notice. It is owing, indeed, to the great agitation the blood receives, and to the irregularity of the heart's internal surface. When the auricles contract, their contents are, in a great measure, discharged into the ventricles, but a portion is thrown back into the veins, which constitutes what is called the venous pulse, and may sometimes be seen in the jugular veins. In like manner, when the ventricles contract, a portion of their contents is thrown back into the auricles, at any rate that part of it situated behind the valves. By these means an agitation is produced which effectually mixes these different fluids together.

It has been ascertained that the veins possess a power of absorption in common with a numerous class of vessels called the absorbents, or lymphatics. These vessels are very minute, and are distributed throughout the whole body; they generally accompany the veins, and, like them, are furnished with valves.

On Respiration and its Effects.—The phenomenon of respiration, which is carried on from the first minute after birth to the last of existence, consists of two acts, inspiration and expiration. The former, that of inhaling the atmosphere, is accomplished mostly by the diaphragm, which, in its relaxed state, is convex towards the chest. As its fibres contract, the muscle flattens, and thus enlarges in a considerable degree the cavity of the thorax. A vacuum is thus produced, or rather a tendency towards it; for the air rushes into the lungs, and the blood into the heart; and, as the lungs are elastic and spongy in their nature, they become closely adapted to the enlargement of the chest, and prevent any vacuum from taking place between them and the sides of the thorax. The diaphragm is thus the chief agent in the act of inspiration, although in some degree assisted by the intercostal muscles, which raise the chest, and also, when the breathing is violently excited, by those muscles that in quadrupeds attach the fore extremities to the body. The air thus drawn into the lungs traverses throughout its internal surface, and, having fulfilled its office, is forced out by the act of expiration. This part of the process is effected chiefly by means of the elasticity of the lungs, which acts as soon as the diaphragm

becomes passive, assisted, however, in some degree by the elastic cartilages of the chest, and occasionally by the abdominal muscles.

Atmospheric air consists of unequal parts of two aëriform fluids, viz. four-fifths of nitrogen or azote, and one-fifth of oxygen in each 100 parts; besides which it contains other heterogeneous matters, such as odorous effluvia, aqueous exhalations, electric matter, and carbonic acid gas. It everywhere surrounds and embraces the globe, extending, in the opinion of some, a distance of forty-five miles, and in that of others a much greater height. Its gravity differs very much at different times and in different places, being heavier on a clear than on a close day, and also in low than in lofty places. The small portion of carbonic acid gas which the atmosphere contains is not chemically, but mechanically mixed with it. This gas is evolved by the fermentation of beer, and the decomposition of vegetables, and is often found in wells and deep places. It is much heavier than the atmosphere, and thus remains in these low places by its gravity. A lighted candle placed in this gas is immediately extinguished; so that it is used as a safeguard in descending into low and foul places; for whatever will not support combustion will not support life. It is not a simple gas, like oxygen, but is formed by the union of carbon and oxygen.

Nitrogen or *azote* is a simple gas, but its use in the atmosphere seems to be principally of a passive nature, being for the purpose of diluting the oxygen and rendering it less stimulating; it will not alone support life or combustion, but is mechanically mixed with the oxygen. Oxygen is essential for the support of life and combustion; for if air be deprived of it no animal can live, nor will a candle remain lighted. It is abundantly furnished by plants and shrubs, which thus restore the loss of it occasioned by animals. When a flame is exposed to this gas it greatly increases in brilliancy; and when venous blood is submitted to it, it quickly becomes florid.

We have before shown that all the blood in the body was in its turn carried from the heart to the lungs by means of the pulmonary artery, which divides and subdivides into the smallest branches, and terminates in small capillary veins, which, coalescing, become larger, and convey the blood again to the heart by the pulmonary veins. Before it reaches these veins, however, an important change takes place; the blood proceeds from the heart in a black and impure state; it returns reddened and purified; it is submitted in its course to the action of the air in the air-cells, not by actual contact, but through the membrane which forms these cells; and by this means the important change is effected. There

is, we well know, a considerable difference between the expired and the inspired air; the former is hot, the latter cold; this is healthy, that injurious; one will support combustion and life, the other is unfit for breathing, and will extinguish a flame. There is but little difference in quantity between the air in its different states, but the oxygen in expired air has nearly disappeared and carbonic acid gas is found in its stead; it also contains much aqueous vapour, which is condensed in a visible form, at a temperature of 60°. Thus, although the carbonic acid gas is much heavier than common air, yet, partly from the aqueous vapour which the expired air contains being much lighter, but principally from its own increased temperature, the expired air, notwithstanding its carbonic acid, is yet specifically lighter than the atmosphere; and consequently rises upwards, and thus, in great measure, is prevented from being respired a second time. It has been found by experiment with a portion of atmospheric air, containing 80 parts of nitrogen, 18 of oxygen, and 2 of carbonic acid, that, on being respired, the nitrogen continued the same, but the carbonic acid was increased to 13 parts, and the oxygen reduced to 5; whence it appeared that 11 parts of carbonic acid were substituted for 13 of oxygen, 2 parts having entirely disappeared. Thus the disappearance of the greater portion of the oxygen was accounted for by its being converted into carbonic acid; but there remained a small portion, whose absence could not be thus explained, more particularly as Sir H. Davy calculated that about 32 ounces of oxygen were necessary for 24 hours' expenditure in a man; but only $26\frac{1}{2}$ ounces are requisite for the formation of even 37 ounces of carbonic acid gas, giving us an unexplained surplus of $5\frac{1}{4}$ ounces of oxygen during the above period. By some it was supposed that this surplus oxygen united with the hydrogen thrown off by the blood, and is thus converted into watery vapour: by others it is held that this oxygen is absorbed by the blood, and enters the circulation. Carbonic acid gas is exhaled from the lungs in different quantities during different periods of the day, being generated in the greatest quantity about noon, decreasing in the afternoon and night, and again increasing in the morning. It also increases in man by taking animal food.

Sir H. Davy contended that a small portion of nitrogen is absorbed by the blood; but this has been denied by others. The chief use of nitrogen, however, is to dilute the oxygen; for if the latter is inspired pure a sense of warmth is felt in the chest, the heat of the skin is raised, the pulse quickened, and other symptoms of excitement are produced. A given quantity of oxygen will, however, support life longer than the same quantity of atmospheric

air. It has been computed that, in the course of 24 hours, about 2 lbs. 8 ozs. of oxygen is consumed by a man. After an ordinary respiration a considerable quantity of air still remains—perhaps four-fifths, one-fifth having been expired.

Having mentioned the changes that take place in the atmosphere, we must next consider in what manner the blood becomes so altered by its passage through the lungs. The blood, as it traverses through the body, gradually becomes darker; it is loaded with carbon, and is rendered unfit for the circulation, and in this state it is called venous blood. If venous blood, taken out of the body, be exposed to oxygen, it quickly becomes red; and so it does if exposed to the atmosphere, but not so rapidly. So, likewise, if arterial blood be exposed to carbonic acid, it quickly acquires the colour and character of venous blood. In the same manner is the colour of the blood changed in the lungs; thus the principal use of respiration appears to be to free the blood from its impurities; and this is effected although the air and the blood do not actually come in contact. It was found, that if blood in a common bladder were exposed to the atmosphere for some time, it acquired a coating of florid blood; and thus, as the membrane lining the air-cells is by no means so thick as that of the bladder, there is no longer any difficulty in accounting for the change taking place. It has been the subject of some dispute as to when the change, or rather exchange, takes place, some contending that the carbon unites with the oxygen in the air-cells, whilst others maintain that the oxygen enters the blood, and there unites with the carbon, forming carbonic acid gas, which is then exhaled into the air-cells. It was found, however, that if venous blood were put within the exhausted receiver of an air-pump, a quantity of carbonic acid escapes; thus proving the presence of this gas in the blood, and supporting the second theory. And as there appears to be a greater quantity of oxygen abstracted from the atmosphere than can be accounted for by the formation of carbonic acid, we must conclude that a portion mingles with the blood and enters the circulation; which theory agrees with the fact that it has recently been discovered, by correct analyses, that both venous and arterial blood contains carbonic acid, nitrogen, and oxygen; but that the latter gas is most abundant in arterial and the former in venous blood.

Although the action of the heart is much more frequent than that of the chest in respiration, yet there is a most intimate connexion between the one and the other; for besides the changes which we have spoken of in the blood, it rushes into the heart when the chest is expanded, and when, from any cause, respiration

is delayed, the pulse becomes less frequent and more languid in consequence of the obstruction in the current of the blood. Thus, in violent fits of coughing, the chest collapses, the air is expelled, and the blood not being purified, is unfit for circulation, and the consequence is the veins of the head become distended, and, in man, the person becomes red or black in the face, and sometimes a blood-vessel has ruptured and death supervened.

The Production of Animal Heat.—This important operation is effected by means of respiration, the chemical process carried on in the lungs. The sensation of heat is derived from the presence of an extremely subtle fluid called caloric, the particles of which have a tendency to repel each other and unite with other substances. Thus, if we touch a body whose temperature is lower than that of our hand, caloric passes from the hand to this substance, and the sensation of cold is experienced; and if, on the contrary, the temperature of the substance is higher, we feel a degree of heat from the passage of caloric into the hand. It is a singular fact, that this caloric may exist in two different states—the one in a free or sensible form, the other in a latent or combined form. Thus two substances may appear to be of the same temperature, and yet one may contain a much greater degree of caloric than the other, but so combined with the substance that it is not sensible to the touch. If, however, the object be exposed to the influence of some chemical agent, its latent caloric may be set free or rendered sensible. For instance, if sulphuric acid and water be mixed together, although each fluid were before cold, the mixture is raised to a high temperature, and caloric is evolved. In the fermentation of malt liquors the temperature of the liquid is raised with the process, and carbonic acid is produced; and whenever, indeed, this material is formed, heat is evolved. Animal heat is kept up and supported by the chemical union of these two substances, oxygen and carbon—the same that produces combustion in our fires and candles. Carbon may be considered as the fuel, not only in ordinary combination, but also in the animal economy, whilst oxygen may be regarded as the fire; and, in fact, this agent, throughout nature, is the cause of what appears to be destruction, but is, in fact, only change of form; such, indeed, is its tendency to combine with other substances. Carbon is supplied by the food, and it is necessary that sufficient should be furnished to counteract the consuming tendency of oxygen, which would otherwise gradually waste and destroy the system. In cold weather and cold climates more oxygen is taken into the lungs, the air being more condensed, and a greater waste of the system would be the consequence were it not for the fact that the appetite is

increased, and more food is taken, particularly that which contains most carbon. This accounts for the fact of the people in cold countries having such a great inclination for oily food, which consists chiefly of carbon, whilst those in hot climates dislike fat of every description, and prefer a vegetable diet; thus the functions of the lungs and the stomach most intimately agree. In cold weather a large fire must be kept up to preserve the animal warmth, and the digestive organs furnish the fuel, or otherwise the tissues of the body would be wasted or consumed.

THE PRINCIPLES AND PRACTICE OF BREEDING.

The management and selection of any breed of sheep must after all become a matter of pounds, shillings, and pence. The question the farmer has to consider is, what description of sheep will in the long run return the most profit; and this question must be viewed in strict relation to the management he will be able to adopt on the particular farm on which he may be located. It is not therefore a simple, but a compound question. It is not merely which breed will make most flesh and fat, but which will make it in the shortest time and on the least food; which can bear the weather, or hard keep, or travelling, or a particular mode of management, with the greatest impunity. All these considerations must enter into the farmer's mind before he can come to a sound conclusion. From the want of making these considerations many fatal mistakes have been made, and a flock has been selected altogether unsuitable to the soil, and incapable of bearing the severity of the weather.

The two breeds which used to appear as rivals in their claims on public attention are the *New Leicester* and the *South Down*. It cannot be doubted that, as far as propensity to fatten and early maturity is considered, the Leicester will not only rival, but eclipse all others; for these qualities the form may justly be considered as a model, and all other breeds will possess these qualities in a greater or lesser degree, in proportion as they possess the similitude of the form and points of the Leicester sheep. The South Down itself will not be an exception to this rule; for if the improved and the neglected specimens be compared together, it will be found that the excellencies of the former consist in those points which approximate most to the Leicester. The wool, too, is also a consideration; for the fleece, from its greater length and weight, will bring in nearly double that of the Down. Where, therefore, the pasture is very fertile, and the sheep can be tended with much care and without exposure, the Leicester has been

regarded as the most profitable of the pure breeds. Its drawbacks, however, are the incapability of the animal for bearing exposure, or travelling, or living hard; in fact, its weaker constitution, and greater liability to inflammatory disorders. It is thus unfitted for the purposes of folding, or for the exposure of the North and South-Downs, and still more so for contending with the severities of the Grampian Hills or the Welsh Mountains. In such localities these sheep could not endure. Then again the mutton is by no means so good as the South Down, owing to the very large proportion of tallow in proportion to the lean. Thus it is not a favourite in the London markets, and accordingly, of late years, the first cross between the Leicester and the Down has been introduced in many instances instead of the Leicester; and it is contended that this first cross is the most profitable sheep that can be fattened, making greater and more rapid progress than the Down, and better meat than the Leicester, and possessing, to some extent, the dark faces of the Down, which sign-manual of their origin renders them a greater favourite with the butcher.

The South Down, or rather the improved South Down—for there is a great difference between the two—possesses most valuable qualities; with a propensity to fatten inferior only to the Leicester, but with later maturity, these sheep are excellent travellers, well adapted for folding, hardy compared with the Leicester, and capable of living on short pasture, and well adapted for the Down farms of the south of England. The mutton, too, is more esteemed than any other, with the exception of the small mountain sheep. Perhaps there is no ancient pure breed of sheep that has undergone so much improvement as the South Down, and it affords the owners of other breeds a proper example, showing what can be done by care and attention, and the application of proper principles. Nothing can afford a better proof of the sterling qualities of this breed than the facts that some forty or fifty years since the price of South Down wool rendered the fleece a matter of great importance; and now, although the comparative price is reduced, and it is never likely to realize so much as the long-wooled fleece, the valuable qualities of the animal and the improvements that have been made have enabled the breed still to retain a foremost rank in public favour.

With these two valuable breeds, each adapted for different pastures, it may, perhaps, be asked, what need is there for any other. It will, however, be found that in the marshes of Kent and many other places, the superior hardihood of the native breeds has rendered them more profitable than the Leicester,

though, unquestionably, crosses with the latter have much improved their value. But notwithstanding the eminent qualities of the South Down, they have in numerous instances given way to the larger Hampshire sheep, and they have been found not sufficiently hardy to endure the severities of the Grampian Hills or the Welsh Mountains. They have been tried and found wanting; vast numbers have been destroyed by the rigours of winter in these bleak situations, and the losses that have accrued to many parties have deterred others from following their example.

The *Cheviot* sheep possess many valuable qualities; decidedly inferior to the South Downs in their fattening powers and their early maturity, they are superior in these points to all other mountain sheep, and, in hardihood, even to the South Down, and are thus the best adapted to their native hills, and all other pastures of a similar character. When carried, however, to the extreme north and the islands of Zetland and Orkney, it is said they are not sufficiently hardy for these extra-rigorous places, although it is probable, with a little increase of care, they might be rendered so, and they would then be far more profitable than the ungainly sheep of the native breed.

These three breeds—the Leicester, the South Down, and the Cheviot—may be considered as the principal pure breeds which this country possesses. They are essential to the variety of pastures which obtain, and without them this country could not be properly stocked. Other breeds, which it may be advantageous to adopt, either possess peculiar qualities which render them valuable or have been crossed extensively with more improved breeds.

The *Dorset* and the *Somerset*, for instance, are valuable on account of the ewes taking the ram so much earlier than other breeds, so that the lambs come into the market when scarce, and thus command a higher price. These qualities have caused this breed to be diffused to a great extent within the circuit of a hundred miles of London. It is a common practice to purchase these ewes in lamb at the Michaelmas fairs in Wiltshire and Hampshire, and to fatten the lamb first and then the ewe, renewing the flock the following year. This practice can be pursued most advantageously by farmers possessing farms with sufficient pasturage in the neighbourhood of the London railroads, and the demand they excite makes it answer the purpose of breeders in the west to supply them. The qualities of this breed, in other respects, are inferior to the Downs; the mutton is not quite so much esteemed, the sheep are not so hardy, and do not possess equal fattening powers.

The ewes, previously to being sold, are usually put to a South Down ram, by which means the lambs have a greater propensity to fatten, have darker faces, and they exhibit no appearance of horns—which are features much looked to in the London markets.

The *Leicester* have been extensively employed in improving the breed of other sheep, and so successful has this practice been in many instances that the result of the cross has produced a breed more profitable than the Leicester itself, retaining the fattening qualities of the sire with the greater hardihood and adaptation to the soil possessed by the native breed.

The *Romney Marsh* sheep have been thus improved. The size and strength of the original breed were, to a great extent, retained; and, exposed as these sheep are to occasional floods, and the deep dikes requiring much activity, the Leicester blood itself would not have contended against these difficulties; but, mingled with the native breed, it improved its fattening qualities and disposition to early maturity, and destroyed much of the old coarseness.

The *Bampton* sheep, or *Devon Notts*, are also striking instances of the benefits of this cross, and are thus well adapted for the rich grazing land of Somersetshire and Devonshire.

The *Cotswold* sheep have been similarly improved; the large frame and length of wool of the Cotswold have been retained, together with much of the fattening qualities of the Leicester sire. The product of this cross has also been employed in Hampshire in combination with the native Hampshire Downs; and the result of this plan, carefully pursued, has been to unite, in a striking degree, the peculiarities of each of the three breeds, the fattening properties of the Leicester, the size and length of wool of the Cotswold, and the hardihood and adaptation to the soil and folding capabilities of the Down.

Another plan, very frequently followed and with much success, is that of being satisfied with the first cross with the improved Cotswold, after which it is contended they degenerate. Others prefer a second, third, and even a fourth cross; that is, they put the produce of the South Down or Hampshire Down and the improved Cotswold to the South Down ram, and use the same bred ram again and again for several generations. By this plan the size of the sheep is enlarged, and the fleece is much more abundant, and it is really astonishing to observe, even after the Down ram has been employed for several generations, how much even then of the qualities of the Cotswold and the Leicester is still retained.

The South Down ram has been employed extensively for the

purpose of improving the mountain breeds both of Wales and Ireland, and the result, when care is taken to retain a preponderance of the indigenous breed, has been very successful.

The Cheviots have been employed for a similar purpose, and the result has been pretty generally attended with success.

Whatever sheep may be selected as most suitable to the soil, it has been fairly shown—that the most profitable management is to bestow on them considerable care and attention. The thriftless economy that would deny them shelter from the pitiless blast, or expose them during the lambing season to the unprotected rigours of winter, has been proved, both by practice and theory, to be as unprofitable as it is cruel.

It has been clearly shown, both by theoretical reasoning and actual experiment, that warmth and thriving are closely connected—that the influence of cold is to waste the body or to render more food necessary; in fact, that to a certain extent warmth is a substitute for food. Thus we see the importance of the fleece during the winter; it preserves the temperature of the sheep and prevents waste, and we cannot be surprised that animals thrive more in the summer than the winter, unless during the very hottest period.

On the majority of farms there is much room for improvement in this respect, and in no case will the advantage of shelter be uselessly bestowed, and the many plans of affording it is a matter worthy of much consideration.

If the lambing season should be early or the weather severe, the benefit of shelter will be doubly apparent, and will abundantly repay the expense bestowed. It is a pleasing circumstance to find that the profit to the breeder and humanity to the sheep are so closely connected together.

The advantages and disadvantages of folding have been the subject of discussion, and have given rise to much difference of opinion. In many farms the advantage of folding was the principal purpose for which the flock was kept; and, indeed, on many light hilly farms at a distance from a town it would be impossible to cultivate the land without a flock. The custom used to be to fold the sheep on a naked fallow every night, and to do this it was often necessary to drive them a considerable distance. Much loss in the carcass was the result of this practice; the tiresome travelling of the flock and the long deprivation of food materially retarded the thriving of the sheep.

The turnip system of husbandry, and particularly the introduction of the Swedish turnip, created a sort of revolution in agriculture. As a substitute for a fallow, turnips consumed on the land

afforded an abundant dressing for the succeeding crop. And the Swedish turnip, by affording a good supply of food at the most difficult period of the year—viz., the latter part of the winter and the early spring, when the common turnip, if kept, would have been rotted by the frost—enabled a much larger number of sheep to be kept on each farm. Whatever doubt, therefore, there may be as to the advantage of folding sheep on a naked fallow, there can be none as to the benefit derived from folding them on turnips, and thus consuming the greater portion of the latter on the spot. The expense both of the carriage of the turnips and the dung is thereby saved, and on hilly land this is very considerable, and the sheep, having abundance of food, do not suffer in consequence. It is a common and beneficial practice to let the fat sheep have the run of the turnips first, and to follow them by the ewes or the poor sheep. Hay is generally given at the same time, and is extremely desirable, as counteracting the effects of the redundant moisture in the turnips, and thus preventing disease. If turnips unlimited are given to ewes in lamb, they are extremely apt to produce abortion, and particularly if the season is mild and vegetation rank and forward. It will be a more prudent plan to draw a portion of the turnips, and give it to the ewes with hay on some old pasture.

On some farms it is customary, after a light coating of dung has been spread on the land as a preparation for wheat, to enhance its virtue by folding the sheep on it, a plan desirable when manure is scarce or weak in quality; but though beneficial to the land, it is otherwise to the sheep, unless some artificial food be given at the same time. It is customary, however, to adopt this plan with ewes in lamb, and it is found to be a safe practice; that is, to give them hay in the fold at night, and keep them on the downs during the day, unless there is a hard frost or snow on the ground.

The value of folding has been estimated to be about 40*s.* per acre, differing, however, according to the manner in which the sheep have been kept, as turnips and succulent food render it better than grass alone. Four hundred South Down sheep are sufficient to fold twenty perches per day, or forty-five acres per year, the value of which is, therefore, about 90*l.* per year, or 4*s.* 6*d.* per sheep. Whether this is sufficient to repay the loss in flesh and wool over that of a different system of management, has been a matter of dispute and a subject of calculation. Some have advised a standing fold on some dry and convenient spot, well littered with straw or stubble. Three hundred sheep have in this manner produced eighty large cart-loads of dung between October and March, and in this manner after the expenses have been

deducted, each sheep has earned 3*d.* per week. This plan possesses several advantages, which render it greatly superior to folding on a naked fallow. The sheep are kept sheltered and dry, and the sheds or yards in which this plan is pursued will be exceedingly convenient at the lambing season. The dung, too, thus formed can probably be more evenly spread on the land than would otherwise be the case.

On heavy lands it is, indeed, impossible to keep sheep in the turnip-field throughout the winter; the wet and dirt would be destructive to the sheep, and the treading of the animals injurious to the ground. For four or five months it is, therefore, indispensable that they should be kept in sheds or on grass, and the turnips carted to them. It is satisfactory, however, to find that this plan is so little more expensive, on the whole, as to be urged by its advocates as a superior method in all cases. In practice it is found that on light soil the convenience of consuming turnips on the land, and the saving of carriage both of turnips and manure, render it the most advantageous plan, whilst on land inclined to be heavy or wet, the use of sheds or standing folds will be the superior method.

Even on down farms at a distance from a town the practice of folding on naked fallows is susceptible of great improvement, by giving the sheep some portion of artificial food, as corn or cake; the dung will be thus considerably improved, the sheep will be stronger and more healthy; and, in fact, a greater number can be kept.

With regard to the application of the manure to the land, there cannot be a doubt that folding is the more profitable method; for the ammonia, which is the valuable part of the urine, is prevented from escaping by being fixed and absorbed by the soil. This superior advantage and greater convenience will, no doubt, perpetuate on light soils the practice of keeping sheep in the field, not only with regard to the breeding ewes, but also with the fatting sheep; whilst on heavy lands a contrary practice will be pursued during the winter months; and with reference to the sheep alone there is no doubt whatever that they will thrive far more rapidly and with less food in an enclosed shed than in the open field.

Folding is largely practised, more especially with the South Down breed; but Mr. Wilson, an excellent authority, states that 'it is well ascertained that the injury done to a flock by this practice exceeds the benefit conferred on the crops; and now that portable manures are so abundant, it is to be hoped that this pernicious practice of using sheep as mere muck machines will be everywhere abandoned.'

Mr. Ruston had for five years tried sheep in the yards, and at the same time had between 600 and 700 sheep and lambs in his ordinary fold yards, which were allowed as many mangold as their bodies would bear, to which was added cake or corn, along with a sufficient supply of dry food in the shape of chaff, hay, and straw, about four yards square being allowed for each sheep, the yards being properly drained, and littered every day with a light covering of straw, and twice a day in showery wet weather. Thus if the sheep be free from lameness when placed in the yards, and the littering carefully attended to, there need not be much fear of foot-rot; their feet should be pared at least every three weeks.

Mr. Ruston considers that six lambs will tread down as much straw as a 12*l.* or 14*l.* bullock, and calculates that instead of 100 bullocks leaving 150*l.* after paying for the artificial food, 600 lambs did leave 390*l.* for the same quantity of food, the sheep thus giving a profit of 240*l.* in excess of the bullocks. The manure may be made in folds in any field by means of hurdles, and thus the expense of carting may be saved. In answer to an enquiry Mr. Ruston states that his opinion on the yarding of sheep is unchanged. He adds, as the result of past experience:—'I have come to the conclusion that on my farm lambs pay better for yarding and consuming mangold than sheep, and that either pays better than bullocks.'

The employment of salt for sheep is too much neglected, particularly in long-continued wet weather, when it is most needed. The following are some instances of its utility from Mr. Falks' essay on 'Salt.' 'Doilly, in France, put up ten sheep, giving each 25 grammes, or four-fifths of an ounce of salt, and to ten others he gave no salt, all being of the same breed and age. After eighty-seven days the ten with salt had increased 84 kilos in weight, the ten without only 76 kilos; the difference of 8 kilos, or 2 lbs. weight in each sheep, besides the condition of the salt eaters being much better. The Farthman Agricultural Society of Silesia did the same; put up three lots of ten each, gave all the same food, hay, straw, potatoes, and beans; and to lot one daily, $\frac{1}{2}$ oz. of salt to each; to lot two, $\frac{3}{4}$ oz. of salt to each; and to lot three no salt. After 124 days there was a difference in the increase of weight with lot one, on each, of $4\frac{1}{5}$ lbs., and lot two $3\frac{1}{4}$ lbs. on each against lot three, which had received no salt; besides, which is still more important in a money point of view, of $1\frac{3}{4}$ lb. of wool and a better fleece against no salt.'

The improvement of a flock by means of breeding requires very considerable and long-continued care.

The qualities of both parents must be considered both with a

view of correcting bad as well as perpetuating good qualities. It must be acknowledged, however, that in the majority of cases the influence of the male preponderates over the female, and the characteristics of the former are more likely to be impressed on the offspring than those of the latter. This is shown in most animals. The mule partakes much more of the nature and the size of its sire, the ass, than of its dam, the mare. A large Cotswold ram on a Down ewe produces an offspring much more resembling the former than the latter; and a pony mare put to a full-size horse will produce an animal half as large again as the dam. Though this, however, appears to be Nature's rule, it is not one without exception, for occasionally we see the very opposite results. In breeding animals of a pure kind the principal rule to be observed is to breed from the very best of both sexes, to cull the faulty ones every year, saving only the female lambs for the future flock that are as free from defects as possible. Of course the flock must be kept up to its proper size, but year by year the finest animals should be selected, until, in the course of time, the flock will entirely consist of them. Until this is nearly accomplished it will not be prudent for a farmer to employ his own tups for the purpose, as he will probably be able to hire or purchase superior rams from others, and it will not do to spare expense in thus raising the character of his sheep. The system of selling and letting tups, which is now becoming general, has led to the extension of improvement throughout a number of districts, has increased the weight and raised the quality of most flocks, and thus materially added to the supply of food for the people.

There are various points that are sought after by breeders, not because of the particular value of those points, but because they are evidence of other valuable qualities, such as aptitude to fatten and early maturity. Thus, in the South Down breed, small heads and legs, and small bones, are esteemed, as they are qualities which are found connected with fattening properties. Black muzzles and legs are also valued, probably because they denote the good constitution and hardihood of the animal. We must, however, take care lest, in carrying these points to an extreme, we neglect other valuable qualities. Straightness of the back, breadth of loins, and rotundity of frame, are points which cannot be disputed, and are not merely *signs* of good qualities, but good qualities themselves. The straightness of the back, so perfect in the Leicester, is by no means natural to the South Down in an unimproved state, but rather the contrary. In the improved breeds, however, it is present, and is justly regarded as an excellent point, giving a better surface for the laying on of flesh, and affording

larger scope for the abdominal organs. Its converse, too—a round or convex back—is produced or increased by the effects of poverty and cold, and is almost sure to follow if the breed is neglected and exposed.

The growth of bone of course requires sustenance, as well as any other part, though not perhaps in the same degree. Large bone, therefore, abstracts nutriment which would otherwise be more profitably employed, and thus is anything but a desirable point in sheep. Horns, for the same reason, are much better dispensed with. One point in sheep, which is justly regarded as extremely favourable, is a soft mellow feeling of the skin and parts beneath. These parts are the cellular or rather adipose membranes, which in fat sheep are full of fat, and in lean sheep, when possessing this mellow feeling, denote the plentiful existence of these membranous cells ready for the reception of fat, which is deposited in them almost in the form of oil.

Breadth of loin and rotundity of frame are qualities that require no observation, having been before alluded to. The former denotes the presence of a large quantity of flesh in the spot where it is most valuable, and it also bespeaks a large and roomy abdomen. A round frame is also the sure attendant of a large abdomen, and an extended surface for the muscles of the back and loins. A general squareness of frame bespeaks large muscles, particularly of the quarters.

What, indeed, is wanted for a well-formed animal, is as much flesh and as little bone and gristle as possible, and this flesh is required where it is most esteemed: for instance, it is much more valuable on the loins and quarters than about the head and upper or scrag end of the neck. A large development of flesh is pretty sure to be accompanied by a disposition to fatten; but for profitable feeding it is essential that these qualities should be developed early—constituting early maturity.

The attempt to improve the breed of sheep by means of crossing is a still more difficult task, demanding not only the application of correct principles, but a great degree of practical judgment and shrewdness. Many have been the fruitless attempts that have been made, and in numerous cases a useful breed have become deteriorated in consequence, or altogether unsuited for the climate or the soil. These results have induced many respectable breeders to condemn the practice of crossing altogether, but certainly without sufficient reason; for the lines of demarcation between one breed and another are by no means so strongly marked as to prevent the union of different breeds producing harmonious results.

The object of crossing is either to increase the size or improve

the shape, fattening propensities, early maturity, or the quality or length of the wool. In producing any of these improvements it would, at first sight, appear that all we have to do is to select a ram of any particular breed most famous for the particular quality we wish to produce. But this will not always do; by so doing we shall oftentimes breed a sheep weak in constitution; or, from too great a contrast between the parents, shapeless mongrels may be produced.

As a general rule to render crossing successful, we should endeavour to find some affinity of constitution between the improvers and those we wish to improve; and such is often found in the character of the wool.

Thus there is scarcely a breed of long-woolled sheep but what has been greatly improved by means of the Leicester ram, whilst it often failed in effecting permanent improvement in short-woolled sheep, amongst which the South Downs have been far more successful. As a general rule, the first cross between a superior and an inferior race is very successful, producing animals approximating, in most respects, to their more improved parents; but after the first cross the breed often deteriorates.

It must, therefore, be borne in mind that crossing is an experiment sometimes succeeding and sometimes failing in producing a proper combination of the qualities of both parents. Judgment is shown in selecting the successful results and rejecting the others; and thus, after a few generations, a breed of sheep is sometimes produced which it is desirable to perpetuate without further admixture; but this selection must be continued for many generations, as the original sins, almost disappearing in the first cross, are continually reappearing afterwards.

As an instance of successful crossing, I may mention the breed between the improved Cotswold and the Hampshire Down. The Cotswold sheep is a large animal, celebrated for centuries for the length and weight of the fleece. As a long-woolled sheep it is superior to most others, but its carcass was very much inferior to the Leicester; and thus, by crossing with the latter, it has been greatly improved in its fattening properties and early maturity, whilst the quality of its fleece has been retained. The Hampshire is a larger variety of the South Down, derived originally in great measure from the flocks of Sussex. Either from economy or choice, the largest and coarsest animals were selected and crossed with the native horned sheep, and this breed has been perpetuated on the farms of North Hampshire for the last sixty years. It is a strong, hardy sheep, thriving well on the open Down farms, and well adapted for turnip husbandry. If such sheep were crossed

with the pure Leicester, in all probability the offspring would not be sufficiently hardy to endure the treatment the Downs receive. But the old Cotswold being hardier than the Leicester, the improved Cotswold is so likewise, and thus the result of the cross between the latter and the Down is sufficiently hardy to undergo the system of the country; and at the same time, by careful selection, the peculiar qualities of the three breeds were to a certain extent united into one, and thus the New Oxfordshire sheep has been produced.

The subject of breeding in and in, or from near affinities, is one which has given rise to much discussion, and on which there still prevails much discordance of opinion. Its merits, however, can be best understood by carefully examining into its advantages and disadvantages. In the human subject, sexual intercourse between near relations is very properly forbidden by law, and appears, indeed, altogether foreign to our feelings; and even marriage between relatives of the second degree, such as cousins, is regarded by many persons as subject to great objection, and apt to entail disease on the offspring, and particularly disease of a mental character. Statistical facts bearing on this matter certainly support this opinion in a marked degree.

With animals there is no reluctance to intercourse between the nearest affinities, and the custom of breeding short-horned cattle closely related has been for a long time practised by breeders of considerable eminence. In the human subject the objections to the practice are at once granted, but let us see whether they likewise obtain with animals. In the former, marriages are generally entered into with little if any regard to the health of the individuals concerned, the consequence of which is that the diseases of the parents, or rather their predispositions, are entailed on the offspring. The result of this is that most families have predisposition to some particular complaint; and thus if two members of the same family have intercourse, the probability is, that if both parents had predisposition to a particular disease in an equal degree, this will be increased in their offspring in a double ratio. But on the contrary, if a man unites with a woman of a different family, and a different predisposition, the idiosyncracy of the offspring to the diseases of either parent is likely to be prevented or retarded.

With animals the case is different. If due attention be paid, a principal object will be to breed from healthy subjects, by which means one fertile cause of hereditary predisposition to disease is prevented. A healthy form and sound constitution are essential to successful breeding, and it is the development of those points

we seek to attain. Thus the principal objection to breeding from near affinities, which exists in the human subject, does not obtain amongst animals; and even if, in the former, mental disease is more apt to occur when this practice is pursued, this also is an objection which does not apply to animals, though it has been urged by some that sheep bred in and in are more subject to diseases of the brain —a conclusion, however, which I am much disposed to doubt.

Thus the objections to breeding in and in are not insuperable; what, however, are its advantages? The stronger resemblance there is in the qualities of both parents, supposing those qualites are good, the more likely is it that the offspring will be perfect. By breeding with a view to improvement, the greatest excellencies are likely to be concentrated in one family; if, therefore, the members of this family were not coupled, they must probably be united to inferior animals of either sex, by which practice improvement will be materially retarded. It is, therefore, very frequently the surest method of arriving at the greatest degree of excellency, and thus it is a practice which has been followed by the most eminent breeders of sheep with the greatest success; yet it does not possess any advantages peculiar to itself and different from those we have stated; and if two rams were obtainable possessing precisely equal qualifications, I should not be disposed to select one because he was a near relation to the ewe, but the contrary.

In and in breeding may thus be either productive of good or bad effects, but in neither case is the result to be attributed to the close affinity, but rather to the circumstances connected with it. If no care is employed either in selecting or culling the flock, unquestionably both disease and defect will arise; and two animals, each predisposed to the same bad quality, being allowed to connect, the predisposition to such defect will exist in their offspring in a twofold degree. If, on the other hand, proper care is employed —if those animals only are allowed to breed that possess good forms and healthy constitutions—then undoubtedly the stock will be preserved pure, disease will be warded off, and the proper form and qualifications will be perpetuated.

It must, however, be observed, that there are disadvantageous qualities which may become hereditary, independent of disease; thus want of prolificacy in the ewes, and a tendency to diminution in size, may be and are often considered to be the effect of in and in breeding. This fact (and its occurrence cannot be denied) may be thus explained: a disposition to acquire fat and an early maturity do not co-exist with prolificacy of the ewe or her nursing qualities (the Dorset excel in the latter and the Leicester in the former peculiarity); now, in improving the breed the former

receives all the attention and the latter none at all; how, then, can we wonder at the result?

Then again, with regard to the size. Animals that grow most in stature have the greatest development of bone—are, in fact, the coarsest. In improving the flock such animals are avoided, not on account of their size, but their coarseness; and thus in the course of time, the larger sheep having been drafted, the flock consists of the smaller and kinder animals.

Many farmers confine their care and attention, as respects breeding, to selecting the ram as distant as possible from their own flock; neglecting the proper consideration of various important points, they avoid, as they would a reptile, the practice of breeding from near affinities, believing it the parent of almost every evil by which sheep are affected. The folly of this idea has been shown; it arises from not understanding the principles by which breeding is regulated.

There are certain diseases by which man and animals are afflicted, which are far more hereditary than others; that is, the predisposition to them is hereditary. Thus insanity, consumption, gout, are of this class in man; one family may be disposed to one complaint, one to another; but if two members of the same family unite, the idiosyncracy is greatly increased, not only for what we can see, but for what we cannot see.

Some farmers are great advocates for a pure breed and a long pedigree, whilst others despise the pedigree and prefer gaining their ends by means of crossing. Each, to a certain extent, is right, and each wrong. A pure breed and a good pedigree are valuable, not simply on account of the breed, but of the circumstances with which it is connected; so, likewise, crossing is often baneful, not simply on account of itself, but for the risks to which it is exposed and the evils which it may induce. A pure breed means a breed which has not been crossed with others, but in this simple view of the case, we may find it with the native flocks of the Kerry mountains or the Orkney Islands. It supposes, however, or is generally understood to denote, some uniformity of character, and also the exercise of care in preserving it from mixture with other breeds. A long pedigree, though it may be useless, yet implies a descent from well-formed animals, and the endeavour, by successive breeding, to perpetuate the good points which the originals possess. It supposes, also, a uniformity of character, both with regard to defects and excellencies; a preservation from those evils which the mixture of a different blood may have occasioned, as well as those good qualities which it is possible a different race may have imparted. Pure breeding is, in fact, to speak metaphorically, the surer and safer, though it may be the

longer and more tedious voyage, which leads to excellence; whilst crossing, on the other hand, is the shorter and more rapid course to the same port, but beset with rocks and shoals, through which it requires a more skilful hand than usual to steer the vessel. A flock of sheep may, by injudicious crossing, lose all their valuable points and become a flock of inferior mongrels, or otherwise so weakened in consequence as to be of much less value. Many flocks of Ryelands and other sheep, it is said, still show the evil effects of a mixture of the Merino blood, and other similar cases could be mentioned. Defects, too, may be engendered, which, though not perceptible in the first cross, may break out in the third or fourth generation, and the uniformity of character originally possessed may be lost; and it should here be mentioned, that it is a general opinion, and one founded on fact, that crossing succeeds best with the first cross, the offspring of the further cross being generally inferior to their parents.

But though crossing is attended by these dangers, yet it does not follow that they are without remedy, or that the practice should be abandoned in consequence. Its advocates may justly point to the name of Bakewell, and the creation of his hand, the New Leicester breed. It has been stated that in forming his breed he procured animals from a great variety of flocks, both short-wools and long-wools; but, though this is doubtful with regard to the former, it is unquestionably the fact that he selected animals wherever he thought he could obtain the wished-for qualities, with, at any rate, no regard to in and in breeding. And though we have no authentic information as to the origin of the breed, yet we cannot doubt that extensive crossing was employed in its creation; but it was employed by a master-hand, and for various generations watched over with the most vigilant care, until a uniformity of character was obtained, and the unrivalled Leicester presented to the admiration of the world. Perfection now being obtained, Bakewell cast away the ladder by which he ascended to such excellence, and then advocated pedigree, purity, and in and in breeding; and why did he do so, but because his breed being superior to all others, he of course could not expect improvement from other inferior animals, but could only preserve his own from degeneracy by retaining them pure. Thus the Dishly breed affords an argument not only for the advocates of crossing, but also for those of in and in breeding; and it also supplies a caution, both to the one and the other, that either practice must be pursued with the utmost judgment and care.

Neither practice is deserving of condemnation; it is the abuse, not the use, that is to be reprobated; but at the same time it is to

be regretted that greater endeavours have not been made to improve many of our native breeds by carefully selecting the best animals for the purpose.

If crossing is adopted, it is very desirable to attend to certain principles by which it is influenced. The more closely the natures of different animals approach each other, the more likely is the offspring they produce to be according to our wishes, for Nature does not delight in contrasts. Long-woolled sheep are best adapted to breed with others having likewise long wool. If two animals very opposite in their qualities are put together, the offspring may resemble either one parent or the other, and the faults of either, or both, may appear in the second or third generation. It is found that the Leicester agree better with the Black-faced and other heath breeds than does the South Down; and the coarseness of the wool of each denotes a resemblance, which, from their very opposite natural pastures, we should scarcely expect.

Crossing should be adopted cautiously, and at first with only a portion of the flock, for we should not run the risk of spoiling the whole; and the success of the first experiment will then regulate the second. It is not a bad practice, where it is intended to substitute a new for an old breed, to do so by using the male animals alone of the new breed for successive generations, until the character of the old breed is to a great extent lost. Thus, if this plan is pursued for several generations, the great grandson will possess seven-eighths of the new blood, and one-eighth only of the old, and in the next generation one-sixteenth of the latter only will be retained. It is in this manner, though not effected with regularity, that nearly the whole of the sheep of Australia have become almost entirely Merinos. It has also been successfully employed with other flocks, and may be considered the cheapest as well as the safest system by which a new improved breed can be made to supplant an old and imperfect one.

Certain peculiarities may be imparted to a breed by a single cross, or a few crosses only, as in the case mentioned by Darwin, where, quoting from Fleischmann, he says:—'The original coarse German sheep have 5,500 fibres of wool on a square inch; grades of the third or fourth Merino cross produced about 8,000, the twentieth cross 27,000, the perfect Merino blood 40,000 to 48,000. So that common German sheep crossed twenty times successively with Merinos had not by any means acquired as fine wool as the pure breed.'

It is a good rule in breeding for improvement, to breed from the best of the kind; and if a superior ram of the same breed can be procured from another flock, by all means to make use of it, and

even to give it the preference if it is equal to our own; but if our own excel all others that may be available, then to use it, but with additional caution, taking care to mark those ewes that are deficient in any of the qualities we wish to perpetuate.

And with regard to crossing, if we do it merely for the butcher, then it is better to be satisfied with the first cross alone; but if we cross to correct a bad or produce a favourable quality, then we should immediately return to our own breed as soon as such effect has been obtained, always bearing in mind that we are treading on soft and treacherous ground, and may, without caution, be plunged into the mire.

It will not be out of place to close this subject by reference to the conclusions we arrived at in our paper on Cross Breeding previously referred to.

We observed: 'That there is a direct pecuniary advantage in judicious cross breeding; that increased size, a disposition to fatten, and early maturity, are thereby induced.'

That whilst this may be caused for the most part by the very fact of crossing, yet it is principally due to the superior influence of the male over the size and external appearance of the offspring; so that it is desirable, for the purposes of the butcher, that the male should be of a larger frame than the female, and should excel in those peculiarities we are desirous of reproducing.

Certain peculiarities may be imparted to a breed by a single cross, as we have before observed.

It has been asserted by some observers, that when a female breeds successively from several different males, the offspring often bear a strong resemblance to the first male; which is supposed to arise from certain impressions made on the nervous or the reproductive system of the female. Although this often occurs, we doubt very much whether it is so frequent as to be considered as a rule.

Although in the crossing of sheep, for the purpose of the butcher, it is generally advisable to use males of a larger breed, provided they possess a disposition to fatten, yet, in such cases, it is of importance that the pelvis of the female should be wide and capacious, so that no injury should arise in lambing, in consequence of the increased size of the heads of the lambs. The shape of the ram's head should be studied for the same reason. In crossing, however, for the purpose of establishing a new breed, the size of the male must give way to the other more important considerations; although it will still be desirable to use a large female of the breed which we seek to improve. Thus the South Downs have vastly improved the larger Hampshires, and the Leicester

the huge Lincolns and the Cotswolds. Although the benefits are most evident in the first cross, after which, from pairing the cross-bred animals, the defects of one breed or the other, or the incongruities of both are perpetually breaking out, yet, unless the characteristics and the conformation of the two breeds are altogether averse to each other, nature opposes no barrier to their successful admixture, so that in the course of time, by the aid of selection and careful weeding, it is practicable to establish a new breed altogether. This, in fact, has been the history of our principal breeds. The Leicester was notoriously a cross of various breeds in the first instance, although the sources which supplied the cross is a secret, buried in the 'tomb of the Capulets.' The Cotswold has been crossed and improved by the Leicester; the Lincoln, and indeed all the long-woolled breed, have been similarly treated. Most of the mountain breeds have received a dash of better blood, and the short-woolled sheep have been also generally so served. The Hampshire and the present Wiltshire Downs have been extensively crossed; the friends of the Shropshire cannot deny the 'soft impeachment,' and the old black-faced Norfolks have been pretty well crossed out altogether. The Dorsets and Somersets remain pure as a breed, although they are continually crossed to improve their lambs. The South Down is perhaps one of the purest breeds we have. No one asserts that the immense improvement of this breed by Ellman was due to any crossing; whether the increased size and further improvement which it has received in other counties have been effected in all cases without a cross of any kind, may be in the minds of some a matter of doubt; yet it is only right to give the arraigned, in the absence of any proof to the contrary, the benefit of such doubt, and consider them still as pure as ever.

We confess that we cannot entirely admit either of the antagonistic doctrines held by the rival advocates of crossing and pure breeding. The public have reason to be grateful to the exertions of either party, and still have they respectively reason to be grateful to each other. We have seen that Mr. Humphrey cheerfully acknowledges the benefit he derived from Mr. Jonas Webb's rams. Had he grudged the expense of seeking his improvements from such a renowned flock, and been satisfied with inferior rams, he would not have achieved the success which has crowned his exertions. So, likewise, with the New Oxfordshire breed. What matters it whether the localities occupied by these sheep were divided between their ancestral breeds, or occupied as now, by their cross-bred descendants? The public is benefitted by having better mutton than the Cotswold alone would furnish, and more valuable

wool than the Downs could supply; whilst the breeders, finding their accounts in their balance-sheet, have very properly perpetuated the breed which has paid so well. Our purpose has been to hold the scales fairly between both systems, having no prejudices to serve. Thus, in defending the system of crossing from some of the objections that have been urged against it, we have no wish to be thought forgetful of the merits of a pure breed.

Although the term 'mongrel' is probably correct as referring to a mixed breed, yet, as it is generally used as a term of reproach, it should not be fairly applied to those recognised breeds which, however mixed or mongrel might have been their origin, have yet by vigilance and skill become, in the course of years, almost as marked and vigorous and distinctive as the Anglo-Saxon race itself, whose name we are proud to bear, and whose mixed ancestry no one is anxious to deny.

When equal advantages can be attained by keeping a pure breed, such sheep should unquestionably be preferred; and, although crossing for the purpose of the butcher may be practised with impunity, and even with advantage, yet no one should do so for the purpose of establishing a new breed, unless he has clear and well defined views of the object he seeks to accomplish, and has duly studied the principles on which it can be carried out, and is determined to bestow, for the space of half a lifetime, his constant and unremitting attention to the discovery and removal of defects.

THE INFLUENCE OF RAM SALES.

When the first edition of this work passed through the press, the Royal Agricultural Society of England had been established but a few years, and it was customary in the prize sheets to offer prizes only to two or three distinct breeds, such as the South Downs and the Leicesters, which were alone thought worthy of special recognition and encouragement. The existence of other breeds was only acknowleged by the giving prizes for long wools and short wools other than Leicester and South Downs, the various breeds competing with each other. In keeping with this, at the annual ram sales the great prices for hiring or sale rams were confined to the breeds we have mentioned. A change, however, has gradually come over the shadow of men's dreams, although it must be acknowledged that the leaders of the Royal Agricultural were the last to awaken from such dreams. Cross-breeding was successfully introduced. Old breeds were greatly improved, and new breeds were established, till it was found that the rams

of these daring rivals, the new and improved breeds, actually realised more than the representatives of the old aristocracy. The Royal Society was at length constrained to recognise public opinion, and reward the innovation it had resisted so long by giving liberal prizes to the new-fangled breeds, which now make, to a great extent, the pride and glory of the annual shows. The ancient superstition abandoned so advantageously with regard to sheep has been allowed to be retained in the case of horses, and the Society has thereby indirectly counteracted and discouraged the breeding of useful animals in this country. Whilst the Society, or rather the few who are allowed to govern in horse matters, have seen that at least four new breeds of sheep have been produced by means of crossing, and have become more valuable than the parent breeds, they have held, by their practice, that no such system can be adopted with horses, and that neither hunters, carriage, or cavalry horses, can be bred except by violent crossing, and the consequent extinction of one of the parent breeds.

To return to our subject, the Ram Sales, there are very few sheep-breeders but what avail themselves of them to improve their stock. Formerly it was customary to use their own rams, or those of their neighbours, scarcely more valuable than ordinary sheep. Now, although it might not answer the purpose of those breeders who neither sell nor let their rams to give the very high prices that public breeders are willing to give, yet nearly all seek for improvement, and in the second or third degree use the ram descended from the flock of some celebrated ram-breeder. As before stated, those public men who make it part of their business to breed rams for public sale, will give the most money for a superior animal belonging to a neighbour. They know full well that it is only by using the best animals that the best can be produced, and therefore it will not do to hesitate as regards price, or they will be passed in the race by others. Thus during the past year, owing to this healthy competition, as much as 150 guineas has been given for the use of an improved Hampshire ram during part of the season only. At the annual ram sales of this breed that take place at Salisbury and the immediate neighbourhood, not less than 500 rams pass through the hands of one auctioneer, and probably an equal number through that of others, so that this locality alone supplies a sufficient number to serve 100,000 ewes, or nearly so. During the last three years Mr. James Rawlence, of Wilton, has let and sold, at his annual ram sales, 140 lambs and sheep, at an average of 15*l.* 12*s.* per head.

The following recent article, from the 'Journal of the Chamber

of Agriculture,' strongly illustrates and enforces the views we have long held. In support of such views we subjoin the excellent article alluded to from the pages of a recent number, and which probably is from the able pen of a breeder of the improved Lincoln sheep:—

'The hirings and sales of rams of the present season are highly instructive, as they display to what an extent the revolution in sheep-farming has proceeded. Time was—and not so long since—when nothing but a well-bred Leicester or South Down would pass muster in the show-yard or the sale-ring. The Royal Agricultural Society, until about fifteen years ago, ignored altogether the existence of those grand Lincoln long-wools that were over great districts rapidly superseding Leicesters in public estimation. The Shropshire breed received just as tardy a recognition. The new Oxfordshire and Hampshire sheep were deemed mere cross-breeds, Dorset horns treated as a forest variety, and Devon long-wools passed by as undeserving the slightest notice. Only thirty years ago the whole of these last-mentioned were deemed coarse and ill-bred, lacking both quality and pedigree, but their extreme usefulness as farmers' rent-paying sheep occasioned for them rapid and widespread propagation. The advancement of these ovian races, in fact, extirpated Leicesters and South Downs just as effectually as only a little earlier those highly-favoured species had occupied and driven from their original feeding-grounds the Teeswaters of the north, the Norfolk heath sheep of the east, and the Wiltshire horns and Berkshire Notts of the south. Almost as completely as the Israelites drove out the Canaanites from Palestine, and the Saxons the Celts from the greater part of England, did the sheep originated by Bakewell expel from the lowland districts of this country the ancient long-woolled breeds, while the fine-grained prime quality Sussex race made similar conquests on the hills and throughout the breeding districts of the south. These improved species were raised to a high pitch of exaltation, and it seemed probable that the perpetuity of their dominion would be ensured. The aristocracy of breeders patronised one or the other, and deemed all other sheep comparatively unworthy of notice. Fashion invested the favourites with a value that it was thought could not be too highly appreciated, and for many years there was no better business appertaining to agricultural pursuits than to breed first-class pedigree Leicester or South Down rams. How does it happen, then, that at the present period other varieties have so outstripped these far-famed tribes, that our "Herd and Flock" notices every week display a comparatively low average for the best bred and

most fashionable pedigree rams belonging to them, while farmers invest such large sums in Lincoln long-wools, Shropshire, Hampshire, and Oxfordshire sheep? At the Walderton sale, shearlings of the choicest South Down strains of the Duke of Richmond, Mr. T. Ellman, and Mr. Pinnix, were sold at 11 guineas and 12 guineas each, and the highest priced ram, although a grandson of the famous Goodwood No. 10, only reached 16½ guineas. At Messrs. Wyatt's auction mart, Cirencester, on the following day, matters bore a worse aspect still. Messrs. Heasman drove the whole of their superior rams away again, not a single one hired. The Earl of Portsmouth did sell one at 11½ guineas, and another at a guinea less, but the others made only from 5 guineas to 8½ guineas. Compare this with the almost universal high averages obtained at auctions of Shropshire and Hampshire rams this season. Taking the latter first, we find that Mr. Rawlence let two ram lambs for the season at 75 guineas and 72 guineas respectively, and obtained an average of 22½ guineas for those let, and 16½ guineas each for the lambs sold. Mr. C. Dibben, however, appears to have realised the highest sum for a Hampshire ram this year, as he let one at Salisbury on the 5th inst. for 162*l.* 15*s.* Shropshires have been letting and selling still higher than Hampshires. At Mr. Preece's Shrewsbury auction, three of Lord Chesham's shearlings made 105 guineas, 110 guineas, and 150 guineas respectively, and one of Mr. Foster's 120 guineas. Two of Mr. Coxon's Freeford rams also realised a 100 guineas and 105 guineas each. A sheep of Mr. Masfen's at the Pendeford sale reached 120 guineas, and at Mr. C. Byrd's sale Mr. W. O. Foster hired a shearling at 156 guineas. But even this high figure was surpassed at Mrs. Beach's sale, when the second prize Hull shearling was let for 200 guineas. Turning to the long-woolled breeds, what a falling off do we find in the demand for Leicesters since the time when Bakewell could let three rams for 1,200 guineas, seven for 2,000 guineas, and receive 3,000 guineas more for the use of the rest of his flock, all in a single season! Mr. George Walmsley's rams the other day only averaged 11 guineas each, and at the great Givendale sale the general average was only 10*l.* 13*s.* 6*d.* But far higher prices were obtained at the auctions and private sales of breeders of improved Lincolnshire sheep, although these were only a few years ago thought almost a cross-bred variety. Taking one of the latest, viz. the sale of Scopwick rams on the 19th ultimo, we find 90 guineas realised for one and an average of 21*l.* 10*s.* each obtained for fifty shearlings. On Wednesday, at the Panton sale, eight rams were let for 300 guineas, the highest price being 140 guineas. The

average for sixty-one rams, including eight let and fifty-three sold, was 29*l*. On Thusday, at the sale of Mr. Kirkham's rams at Biscathrope, the competition was exceedingly keen, the seventy rams making an average of 35 guineas; the highest price realised was 120 guineas. We find no difficulty in discovering a sufficient cause for this revolution in the ram market. The high ranges of value both mutton and wool have taken in recent years have made flock-masters desirous of feeding those sheep which will yield them the largest products of both in the quickest time. The South Down may exhibit greater refinement of breed than the Shropshire and Hampshire, and produce better quality of mutton; but breeders and graziers require to combine quantity with quality, and to convert their green crops into mutton and wool by those sheep calculated to give them heaviest cash returns. The Leicester, too, is of surpassing excellence in perfect symmetry of shape, refinement of bone, and in affording a minimum of offal; but by the improved Lincolnshire long-wool the flockmaster obtains much greater weights of both fleece and carcass, with a more intimate admixture in the latter of lean flesh with fat to render the mutton more adapted to a refined palate. There can be little question that these modern breeds, some of which have been created almost within the memory of the present generation, being so well adapted to meet the wants of the times, will extend still further over the land; nor need we be ashamed of any one of them. A gratifying feature presents itself in the present phase of sheep development in England, that quality is so assiduously cultivated in every breed that grand sheep of singular merit are annually turned out from the leading flocks, whether they be Lincolnshire, Shropshire, Cotswold, Oxfordshire, or Hampshire, in denomination and nature. Probably the South Down will always find a home on the Sussex hills, as no other sheep will bite so closely the fine herbage of the chalk downs, while the extensive demand for prime rams of South Down and pure Leicester blood, for crossing purposes and to refine other breeds, may be expected to continue and ensure perpetuity to the best flocks of their kind. But, judging by the indications now furnished by sales and lettings of rams, we may conclude that other breeds are coming, or have come, into more widespread adoption and general favour.'

ON WOOL AND ITS MANUFACTURES.

The woollen manufacture is one of the oldest, as well as the most valuable, which this country possesses. It has been said that the

Romans introduced the arts of spinning and weaving, and established a manufactory for the purpose in the ancient city of Winchester. Under the Saxon monarchy it was assiduously cultivated, but in a domestic form. The females of the house were usually employed in the art, which was esteemed so honourable that princesses and noble ladies did not disdain to engage their hands in its pursuits, and thus indeed the present term of 'spinsters' for unmarried ladies had its origin. The cultivation of wool in the feudal ages formed one of the leading sources of national wealth, and indeed was sometimes used to supply the limited coinage of the country. It often afforded to the sovereign a means of waging a war or paying a ransom. The Low Countries, however, took the lead in the manufacture of woollen goods whilst attached to the Spanish monarchy; but the religious persecutions, and the tyrannical and oppressive conduct of the government, crippled the industry of the country, and drove its industrious Protestant artizans to other lands. England afforded to them its protecting arm; and from this source the prosperity of our woollen manufactures may be considered to have arisen. It took the lead amongst the countries of the world; and, in spite of impolitic laws at home and oppressive imposts abroad, it has hitherto maintained its high position, fluctuating, however, according to the degree in which it has been either shackled or unconfined. And notwithstanding the sudden rise and remarkable progress which the cotton manufacture underwent during the latter part of the last century, the woollen trade has continued its steady progress, apparently but little affected by it; and such is the extent to which it has now reached, that it amounts annually to thirty millions sterling, and employs nearly a million and a quarter of artisans.

In almost every country, with the exception of Britain, the fleece of the sheep forms the principal value of the animal; it is therefore the chief object of the breeder's attention, and the carcass is comparatively neglected. In this country, such is the demand for meat of good quality, and the price it realises, that the wool becomes a secondary consideration. That form of animal most productive of meat is most sought after; and this will continue to be the case whilst wool of the best and finest quality can be readily procured from other countries.

To this may be added the fact that the dampness of the climate in this country is unsuitable for the production of fine wool, and the system of management altogether is opposed to it. A considerable quantity of straw and other dry food, with nightly shelter, is the method successfully employed in Germany for improving the fleece; turnips and a moist diet are unfavourable to

it; and even on our driest pastures, the Downs of the south of England, the chalky soil gives a roughness to the wool. Thus the very same system which improves the carcass deteriorates the wool, so that fat mutton and fine wool cannot prosper together.

Wool differs from hair principally by growing in a spiral form, and being more pliable and softer, and having an unctuous secretion, whilst it resembles it by springing from small bags beneath the skin, which it penetrates. Like hair, each filament is a minute tube filled with pulp, but has a scaly external structure pointing to the extremity, and to which it owes its felting power and its adaptation for clothing purposes. In many wild breeds hair is greatly intermixed with the wool, which is thereby deteriorated, but frequent shearing lessens or eradicates it.

In this country the fleece will generally come off itself every year in the warm weather—a period which is anticipated by shearing. Lambs are generally allowed to go unshorn, which improves the fleece of the following year, and obtains for it, as teg wool, a somewhat higher price. The wool of this country has been long distinguished as *long* and *short* wool, to which used to be also applied the terms *combing* and *carding* wool. This latter distinction, however, no longer applies, for the greater part of the short wool that was formerly used in making cloths is now devoted to combing purposes. This is owing to the great superiority of foreign Merino wool, and to the restrictions which formerly prevented its introduction now being removed. This, of course, has materially reduced the price of British short wools, and it would have been still further reduced had not the improvement in machinery enabled the short wool to be devoted to combing purposes. The same fleece affords wool of various degrees of fineness; and it is the business of the woolstapler, who purchases the fleece of the grower, to sort these various qualities, and prepare them for the manufacturer. The fleece is unrolled, and the workman, having a number of baskets around him, selects the fine locks from the coarse ones, and arranges them in the baskets with a degree of celerity surprising to the uninitiated. He is directed both by the sight and touch in this operation, and is obliged to serve a regular apprenticeship before he acquires the proper degree of skill. The finest wool is procured from the neck, shoulders, and sides; the next from the upper part of the legs and thighs, extending to the haunch and tail; and the most inferior is distributed on the upper part of the neck, throat, belly, breast, and part of the legs. The stapler, however, arranges it in six different allotments, and the finest wool is divided into no less than ten; and these are termed, according to their degree of

fineness—beginning with the picklock, which is the best—the prime, the choice, the super, the head, the downrights, the seconds, the abb, the livery, and lastly the breech wool. These divisions, which would be much better expressed in numerical order, denote the variety which exists even in a single fleece. *Carding* is a name given to the process which wool undergoes in being made into cloths or woollen goods, whilst *combing* is a part of the process in making worsted goods. Short and fine wool, for the most part, is employed for the former, and long and coarse wool for the latter. The card is an instrument which breaks and divides the wool into a multitude of fragments, which, from the spiral growth of the wool, are necessarily left in a curved state; and from this and another cause they are disposed to lock together and adhere on being subjected to moisture and pressure, as is shown in the felt of a hat, which is thus made. This disposition is called *felting*. After being broken into fragments which adhere loosely together, it is spun and woven into cloth, being for this purpose well oiled. It is afterwards fullered; that is, the oil is extracted by means of fullers'-earth, and it is the moisture and pressure of this process which call out the felting properties of the wool, and give it that close and dense appearance which fine cloth assumes. Wool for worsteds, on the other hand, is combed smooth and not broken into pieces, and is then spun, so that it retains a looser appearance.

The perfection of wool-spinning cannot be better illustrated than by the facts that in ordinary spinning a pound of wool is made to extend upwards of 1,300 yards; in superfine spinning, a distance of 22 miles; and it is an established fact that this quantity has been spun into a thread reaching the incredible distance of upwards of 95 miles.

The felting property and other qualities of different wools have long been made known by practical experience, but we are indebted to Mr. Youatt for the discovery that the felting property depended in great measure on the number of serrations on its surface. This gentleman, after several laborious attempts, at length succeeded, with the assistance of a powerful achromatic microscope and its scientific maker, in developing the singular structure of wool and the difference between wools of different qualities. Each fibre was found to consist of a number of leaves attached to a central stem or band, and extending in one direction, viz. from the root to the point. This was the result of examining a filament as an opaque object; but when viewed as a transparent object, the edges of the leaves were more visibly apparent, appearing like so many teeth pointing in one direction, and thence properly

termed the serrated edge. The fibre of wool thus magnified appears somewhat like the common fir-apple. On examining different wools, Mr. Youatt found that the number of serrations corresponded to the felting qualities of the wool, being in the Saxony no less than 2,720 in the inch, in the South Down 2,080, and in the Leicester 1,860 alone.

Thus fine wool differs from coarse in having a greater number of serrations and growing in a more spiral form, which, of course, increases the number of curves, but to this we must add the fact of its being actually finer or smaller in its fibres; so that whilst a fibre of the coarsest wool is $\frac{1}{450}$, the finest is $\frac{1}{1500}$ of an inch in diameter. The softness of fine wool is another interesting peculiarity; but this may be in great measure owing both to the minuteness of its fibres and the number of its serrations.

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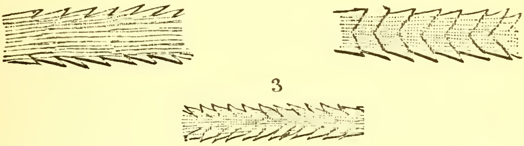


1. THE LEICESTER. 2. THE SOUTH DOWN. 3. THE MERINO.

Fibres of three different wools viewed through an achromatic microscope and sufficiently magnified to show the serrated structure of the wool, as well as the relative size and appearance of the different kinds.

It can easily be conceived how this curious structure of the wool, particularly its serrated edge, must conduce to its felting property. As long as the filaments are kept in the same direction, these serrations are comparatively inoperative; but torn to pieces by the card and mixed in every direction, the serrated edge must tend to hook and entwine together, and this must be pretty much in proportion to the number of serrations in a given space, particularly when this is added to the fact that the wool is more curved as the serrations are numerous.

In preparing the wool for worsted goods the filaments are arranged in a uniform direction by the comb, and spun. Thus carpets and other worsted goods present a looser and more open texture than cloth or woollen goods. The felting property of the wool is not called into operation, and is in fact much impaired by the necessary processes. The object is to get as fine and even a thread as possible. There are no less than eleven distinct operations under which the wool goes before the manufacture is completed. These are—sorting, washing, drying, plucking, combing, breaking, drawing, roving, spinning, reeling, and weaving.

A considerable quantity of British wool is obtained from the skins of slaughtered animals, and the separation of the wool and preparation of the skin is the business of the fellmonger. Mr. Southey, in his little treatise on wool, thus describes the process: 'The skins should be obtained as soon as possible after the death of the animals, when this process is usually adopted:—The first operation is to place the skins, one by one, on a flat stone, and to beat the parts round the head with a wooden mallet, for the purpose of loosening any clots or tufts of coagulated blood adhering to them. The skins thus prepared are then thrown into a vat of water to soak, in order to soften any substance or concretion which might attach to the wool. After remaining immersed from ten to twelve hours, the operation of washing commences.

'When this operation is concluded, the skins are placed one upon another, to the number of twenty or thirty, for the purpose of draining; and afterwards they are laid one by one on a table, with the flesh or pelt side uppermost, when a strong solution of lime and water should be applied to the fleshy side of the skin; and when thus properly smeared over by one person, another should be in attendance to fold the skins, one by one, taking care that the pelt sides are placed inwards; and so soon as this is done they are put on poles and laid about six deep, one above another. This mode is adopted for the purpose of causing the skins to heat, preparatory to the wool being pulled, as the process operates in such a manner as to open or loosen the pores of the skin, by which means the wool is more readily drawn from it.

'The day after the skins have undergone the operation of liming and washing, they are taken down from the pole to shake off any water from the extremity or points of the wool, which, if suffered to remain, would tend to discolour it. The skins, however, remain on the poles until the pores are partially relaxed, which may be ascertained by trying to separate the wool from the skin, as it will leave the pelt when in a proper state of preparation. The skins are then placed in an inclosed shed or warehouse, from which the air is excluded, and each skin suspended by the nostrils or nose to afford greater facility in the operation of pulling. Before this commences a lad is usually employed to cut off the pitch or any hard substance that may adhere to the skin, taking care not to shorten the wool. Previous to the operation of pulling being commenced, the skins should be inspected and assorted somewhat after the following method:—Those which are found deteriorated with kemp, or dead hairs intermixed with the wool, or marked with party colours, should be laid aside by themselves and kept separate from those which are entirely white.

It would, in fact, be advisable, where the skins are numerous, to separate those which produce long wool from others of a shorter growth, as each class of wool is by the manufacturer applied to different purposes.

'There are very few party-coloured sheep in English flocks, and not many interspersed with dead or kemp and black hairs. When any perchance do appear, they should be separated from the rest, and their wool kept distinct, any intermixture being extremely detrimental to the consumer, who carefully avoids buying objectionable wool, except at low prices, and to this minute attention should be paid by all those who aim at producing skin wool of an approved quality. The coarse hairy parts about the legs should in like manner be first withdrawn and thrown aside, being entirely useless to the English manufacturer and injurious to his interest.

'When the skins have been properly limed and folded, in the course of two or three days, when the weather is warm, they are generally in a fit state to be pulled, which being done, the wool should be placed in a loft or open warehouse, and exposed to a free current of air to dry and become fit for packing, as otherwise it might be discoloured by heat, or even ignited, of which I have myself seen a most remarkable instance, by which means a considerable amount of property was destroyed. During a wet season, or in the winter months, the skinner usually has recourse to an inclosed warehouse, heated by iron pipes raised perpendicularly from the floor, in which a large fire is made of coke. These pipes are passed through several floors where wool is exposed for drying; and at periods when the sun does not afford sufficient warmth to the atmosphere, it is customary to place the skins in an artificial heat of this kind, which proves a substitute for the sun's rays, and prepares the skin for the process of being pulled.

'The English fellmonger draws out the wool from the pelt by hand, the men placing the skins before them on an inclined board, but has occasionally recourse to the aid of an implement called a pulling-knife, which the operator uses in order to assist him in removing the wool from those parts of the skin which have not been sufficiently decomposed, owing to their not being so equally saturated as the rest.

'The skins, after being divested of their wool, are usually placed in a pit or vat filled with lime-water of a moderate degree of strength, compared with that usually applied to skins with the wool attached to them. There they remain two or three days, for the purpose of extracting any portion of the grease usually found attached to the pelt. Thence they are removed by long iron

tongs to a stronger solution of lime-water, and daily drawn up and exposed to the air for several hours during the day, but out of the sun's rays in hot weather. They are then again thrown into the prepared liquid, care being taken to stir up the water previous to their immersion. In this state they continue three or four weeks, or are disposed of in the intermediate time to leather-sellers, parchment-makers, or glue-manufacturers, according to their various sizes and their condition.'

Formerly, and particularly during the old continental war, which put a stop to commercial intercourse between this and other European countries, and before we obtained any supply from our colonies, the wool of this country was valued in proportion to its fineness and its adaptation to felting purposes: wool of this description realised such high prices as induced the growers not only to cultivate the fleece, but to breed from those animals whose fleece was the finest. It was then that the South Down wool was entirely confined to carding purposes, and was highly esteemed. The old horned sheep of Hampshire, Wilts, and Berkshire were devoted to a similar purpose, whilst the little Ryeland bore a striking pre-eminence over all others. It was under the influence of this artificial stimulus that the Spanish sheep were imported into this country, and the most sanguine expectations were entertained as to the result. It was thought to combine, in one animal, the advantages of the fleece and the carcass too; and even after this was found to fail, the superiority of the Merino fleece was sufficient to induce many farmers to sacrifice the carcass for its sake. Soon after the peace, however, the restrictions on the importation of foreign fool were gradually lessened or removed, and the Merino sheep having been largely and successfully cultivated throughout Germany in the meantime, the superiority of the Saxony over the British wool was immediately apparent; and the price at which it could be procured being comparatively low, down fell the price of wool, and with it the hopes of the farmers, so far as they were built upon it. The pure Merino was cultivated at too great a sacrifice of flesh, and the mixed breed proved to be so inferior to the foreign in quality, that neither were found to pay, and thus we cannot wonder that they have been gradually discontinued or crossed out; and it has now become a settled point that fine wool cannot be grown profitably in this country. This is the less to be regretted, inasmuch as our widely-extended Australian possessions offer a vast field for its successful cultivation, where the extent of pasturage, the cheapness of the land, and the suitableness of the climate, altogether point towards this peculiar branch of industry. The wools from these colonies have

gradually improved, and the best qualities now rival that of Saxony, and have increased in quantity to an enormous extent.

The British fine wool being thus, as it were, driven out of the market by a superior article, attention was very properly directed to quantity rather than quality, and thus a stimulus was given to the long-woolled breeds. The long and the short wool of this country having nearly, if not quite, approximated in price, it was found, of course, that it was more desirable to have a fleece of six pounds and upwards than one of three only; and particularly as these breeds, having been greatly improved, could be cultivated to greater advantage in suitable soils, with regard to the flesh alone. Thus we have the reasons why the production of long wool has so greatly increased in this country, that whilst in 1800 there were only 131,794 packs, in 1828 there were no less than 263,847, being an increase of 132,053; whilst during the same period the packs of short wool have decreased to the number of 72,820. The improvement in agriculture has enabled the farmer to keep long-woolled sheep in situations where the short-woolled alone could exist before.

During the period of these changes the consumption of worsted goods, both at home and abroad, has greatly increased, and with it the demand for long wool, so that it would soon have realised a superior price to the short wool of this country, had not the improvement of machinery enabled the manufacturer to use the short wool of Britain likewise for combing purposes, and particularly for the production of goods of a peculiar kind, such as the Petersham and friezed coatings, army and navy cloths, besides blankets and other coarse woollens; so that at the present time there is but little, if any, difference in price between the long and short wool of this country. It appears from the tables of Messrs. Luccock and Hubbard, that in 1800 the number of packs of short wool produced in England alone was 193,475, whilst in 1828 it was reduced to 120,655; and on the other hand, in the former year there were only 131,794 packs of long wool, whilst in the latter year there were no less than 263,847. The total number of sheep kept in Great Britain and Ireland was estimated by Mr. M'Culloch at 32,000,000, and the weight of wool at 124,800,000 lbs.*

Though both British long and short wool are mostly used for similar purposes, viz. the manufacture of worsted goods, and

* The agricultural returns for 1872 show the number of sheep to be 32,246,642; and if the produce of wool amounts to 260,000,000 lbs., the fleeces must have doubled in weight, whilst the number of sheep have scarcely increased.

carding wool is almost entirely of foreign growth, yet the amount of wool grown at home greatly exceeds that imported; for whilst the latter is about fifty millions of pounds weight, the former is, as we have seen, nearly one hundred and twenty-five millions, from which may, however, be deducted about eight millions exported to other countries, and particularly to Belgium.

This immense trade appears to have gone on, though with occasional checks, yet on the whole progressively increasing up to the present time; so that the declared value of worsted and woollen goods in the year 1838 amounted to nearly six millions sterling, of which the United States, our best customers, took nearly two millions. It has not, however, increased by any means after the same rate as our importation of foreign wool; for whilst the latter increased one-fifth between the years 1835 and 1838, the exportations in the latter year were less than in the former in nearly the same proportion. The following table will show the difference of the importation of wool between these years, as well as the countries from whence imported:—

Country whence imported	1835	1838
	lbs.	lbs.
Germany	23,798,186	27,506,282
Russia	4,024,740	3,769,102
Rest of Northern Europe	1,157,345	1,063,074
Spain	1,602,752	1,814,877
Italy	1,051,005	1,758,894
Grecce	1,281,839	848,091
Rest of Southern Europe	1,304,416	1,040,613
Northern Africa	816,625	511,426
Southern Africa	191,624	422,506
Rest of Africa	5,102	1,867
Australia	4,210,301	7,837,423
East Indies	295,848	1,897,266
South America and Mexico	2,195,400	4,059,958
North America	239,349	62,976
All countries	42,194,532	52,594,355

From the above table it will be seen that the total amount of foreign wool in 1838 exceeded that of 1835 by upwards of ten million pounds. Of this the highest rate of increase has been from our own colonies in Australia, where it amounts to nearly double, with the exception of an almost new trade which has sprung up in the East Indies, where the amount in the latter year is six times that of the former. The wool thus imported is in great measure produced in Central Asia, as well as the more elevated regions of Hindostan, and is of a peculiar short and soft

quality, superior in this respect to all others. This trade is likely to increase to a great extent, since the Indus has been opened to British enterprise, and the province of Scinde (which appears to have produced a very considerable amount) has come more immediately under British sway. It appears from the report on the Commerce of Bombay for the year 1838-39, that there was in this official year imported into Bombay, from the subordinate ports in the Concan and Guzerat, 343,981 lbs. of wool; from the Persian Gulf, 12,012 lbs.; from Cutch and *Scinde*, 1,390,043 lbs.; and from Guzerat, 343,981 lbs. Of this, 1,882,285 lbs. were exported to Great Britain, and 57,713 lbs. to France. There appears likewise to have been a considerable increase from South America and Mexico, and also from Southern Africa and Italy; an increase of one-sixth both from Germany and Spain; and from all other countries a decrease. It should, however, be observed that the importation from Germany in 1825 and 1826 exceeded that above quoted.

The price of wool in this country appears to have varied very much at different times. The following table will show the value of the principal sorts at the end of June 1841:—

	s.	d.		s.	d.	
Saxon	1	9	to	5	0	per lb.
Austrian, &c.	1	4	„	3	6	„
Spanish	1	6	„	2	2	„
Australian	1	2	„	2	4	„
Van Diemen's Land	1	1	„	2	3	„
Cape	1	0	„	1	9	„
British Fleeces	1	1	„	1	5	„
South Down	0	10	„	0	10½	„
Kent Fleeces	1	2	„	1	3	„
Leicester Fleeces	0	10	„	0	11	„
In yolk, Devons	0	7	„	0	9	„

The above are the prices of wools usually found in the market, but particularly fine specimens commanded higher prices than any quoted above.

In addition to the preceding returns we are enabled to give the following importations of Australian wool into London, Liverpool, Bristol, Hull, and Leith in the following years:—

	Bales		lbs.
1841	53,015,	or	12,723,600
1842	52,897,	„	12,695,280
1843	67,610,	„	16,226,400

From this return it appears that, although the importation of Australian wool was less in 1842 than in the previous year, yet

in 1843 it again revived, and exceeded the importation of the previous year by upwards of three and a half millions of pounds. This satisfactory increase affords just reason to expect that this trade, so valuable and important both to the mother country and the colonies, will continue steadily and progressively to advance.

It is a singular fact that in this country the number of sheep have not increased for many years. We find the return given in the text some thirty years ago is thirty-two millions, and in the Agricultural Statistics for 1872 the sheep stock is returned as under thirty-three millions; yet we know as facts that the consumption of mutton and the production of wool have been vastly increased, and the artificial food consumed by our flocks has been greatly extended. The cause of these changes are no doubt twofold. The size and weight of sheep, as well as their wool-bearing qualities, have been greatly increased by the great attention bestowed on breeding; and early maturity has been so developed that in many instances fat sheep are heavier at one year old than they used to be at two and upwards, and thus the production of mutton has been doubled from the same number of sheep as well as increased by the larger size of the animals. There is no mistake so great as that commonly entertained that the production of meat is diminished by the slaughtering of young animals, the contrary being precisely the fact. This is even the case with lambs, the average weight of which when killed is equivalent to that of sheep in former years. The number of sheep in this country is ruled very much by the amount of natural food available for sustaining them; thus the dry years of 1868 and 1870 caused a great diminution in the number, amounting to several millions, which number is only now being gradually restored. Whilst the number of sheep in the United Kingdom has only increased to the extent of a quarter of a million, the last returns showing 32,246,642, the production of wool has been raised from 125 millions to 260 millions of pounds, and the increase in our colonies has been in a still greater proportion. Mr. Finlay Dun, in an excellent essay on Sheep in the 'Journal of the Royal Agricultural Society,' written in 1856, observes:—'The sheep of the British Isles are believed to number about 35,000,000; England alone possessing about 27,000,000; Scotland, according to the Agricultural Statistics of 1854, has 4,787,235; and Ireland, in 1853, had 3,142,656. Calculating the 35,000,000 as worth 30*s.* a head, the sheep stock of Britain is worth 52,500,000*l.* sterling. About 10,000,000 sheep, weighing on an average 80 lbs. each, are annually slaughtered for food. This furnishes 800,000,000 lbs. of mutton, or on an average rather more than half a pound per

day for each individual in the three kingdoms. The mutton at 6*d.* per pound is worth 20,000,000*l.* sterling. Professor Low estimated that, allowing for the deficient weight of the wool of slaughtered sheep and lambs, each sheep averages 4½ lbs., and the total annual produce of wool will therefore be 157,500,000 lbs. Fixing the value at 1*s.* 3*d* per pound, the total yearly value of the wool of Great Britain is nearly 10,000,000*l.* sterling.

Since this estimation, although the numbers are diminished, the weight of wool and of mutton is increased.

ON FEEDING AND FATTING, &c.

Though in many countries the principal value of sheep is to be attributed to their woolly covering, yet in this country, for some years past, the flesh has been the greatest source of profit, and the carcass therefore the paramount consideration.

This has naturally led the attention of breeders to the consideration of what particular breed has the most aptitude to make flesh and fat, how these qualities can be improved, and what particular shape or form is connected with this propensity to fatten? But though the above has been perhaps the principal consideration kept in view, there are other subordinate ones springing out of it of scarcely inferior importance—such as which breed, or individual sheep, will fatten soonest on good pasture? Which will do best on indifferent or bad pasture? Which has the earliest maturity? Which can bear wet and dirt with the greatest impunity, or can best endure exposure to the weather in a cold and severe locality?

These several points must all enter into the consideration of the sheep-owner, who must of course pay the utmost attention to the nature and quality of his land and its suitability for particular sheep; being, after all, governed by the ultimate calculation as to which brings in the greatest return of profit.

The various points in the form of a sheep, connected with the aptitude to fatten, have received the utmost attention from practical and sagacious breeders, although some of these points are still matters of dispute. The superiority of particular improved breeds is now generally acknowledged, and may indeed be considered to be established on certain principles, though in arriving at these principles it must be confessed that we are little indebted to science, but rather to the long and attentive observation and correct reasoning of sagacious and practical men. It is, indeed, only very lately that anything like a correct explanation could be offered for the various phenomena that attend the fattening of animals, or

why one description of food should be more suitable for the purpose than another. It used to be supposed that a large capacious chest and lungs were necessary for the production of fat, and that its secretion depended in a great degree on the quantity of air that could be respired; whilst the researches of modern chemists have shown that nothing could be further from the truth. And now that the fallacy has been exposed by chemistry it can also be readily shown by anatomy, for we find that whilst the horse and the camel have eighteen ribs the ox and the sheep have only thirteen. The absence of these five pair of ribs must of course materially diminish the cavity of the chest, and its greatest breadth (necessary for another purpose) does not by any means compensate for its diminished length. Animals of speed have rarely a propensity to fatten; but in greyhounds, foxes, hares, deer, &c., we find the chest is long and deep though not wide, whilst in pigs, sheep, and oxen we notice an opposite conformation. The fact is, in proportion to the activity of the animal is its respiration and its demand for oxygen, and in proportion to the consumption of oxygen is the wear and tear of the system and the consumption of the elements of the food. If the exertions are therefore excessive, that portion of the food that would have increased the weight of the body is called for to support respiration.

In animals having a propensity to fatten, we find the chest of a circular form; the ribs spring from the spine more horizontally than in others, almost at right angles: this is observed in the ox, compared with the horse, and still more so in the sheep. The effect of this conformation is certainly in one respect to increase the width of the chest, but another important effect is to increase very considerably the size of the abdomen; for in order to obtain the greatest possible nutriment from the food, it is essential that the organs of digestion should be capacious, which cannot be the case unless the cavity in which they are situated is large. The abdominal muscles and the membrane which supports the bowels are attached to the cartilages of the ribs, and the short ribs in some measure cover the abdomen. It is, therefore, evident that in proportion to the width of and between the posterior ribs must, in a great measure, be the size of the abdomen; and this width must be in proportion to the horizontal direction in which the ribs are given off. The loins must correspond with the ribs; the transverse processes are long and horizontal in proportion to the horizontal manner in which the ribs spring from the spine; for, in fact, they are but a continuation of the same roof, and must possess the same relative proportions. We may illustrate this point by comparing it to an umbrella, which, when thoroughly open, the ribs, so to speak, coming off at right angles may be compared with

the broad circular animal, and, when only half extended, to the narrow-chested flat-sided beast. In its former state the umbrella forms the roof of a much larger space than it does in its latter state; and, in the same manner, the long transverse lumbar processes must form the roof of a larger abdominal cavity than the short transverse oblique processes found with narrow loins. The same form that extends the roof of the abdomen also gives a larger surface for the muscles of the back and loins to rest on; and thus we find in sheep of this description a very considerable development of the flesh or muscles of the loins—the primest part of the carcass. It is a common observation with judges of sheep, that one of the best points is a channel between the shoulders and along the back. This is, indeed, a desirable form, for it is connected with those necessary qualifications for producing flesh and fat. The channel along the back is owing chiefly to the large development of the muscles of the loins and back arising from the form we have commended, and partly to the shortness of the upright or spinous processes of the vertebræ of the back. Now the use of these processes is to afford leverage to the muscles, and their length therefore enhances the activity of the animal. Sheep, however, do not possess or require these active powers, and they would, in fact, be very detrimental to the priucipal object of the animal's existence; it is a quiet state and a quiet disposition that dispose an animal to increase in flesh and fat. The shortness of these processes is illustrated in the sheep as compared with the goat, and in the improved breeds of the former as compared with those of the mountain and the forest.

It is an ordination of nature that nothing is lost or entirely destroyed. If we set fire to a quantity of straw, a few ashes only remain; but the rest does not cease to exist, but has merely assumed other forms—it has assumed a gaseous character, and passes into the atmosphere. A majestic tree, in the course of years, is produced from an acorn or nut. In reaching this form and bulk it does not produce any new elements; it merely has the power of assimilating or assuming to itself that which before existed either in the atmosphere or the soil. Vegetables derive their subsistence chiefly from the atmosphere; animals, on the other hand, entirely from the food conveyed within the body. A young animal increases daily in size and weight; in so doing it has the power of assimilating the nutritious portion of the food, and causing it to assume the form of blood and flesh, &c. The various parts of the body possess, therefore, that which previously existed in the form of food. The locomotion of animals requires a certain force to produce which a constant waste or loss of substance is undergone—living parts become dead parts, and are at length cast from the system. To

supply this waste, food is required; and when the animal neither increases nor diminishes in weight, the waste of the system and supply of food are equivalent to each other. When the body decreases in weight, the waste is greater than the supply; and when the body increases, the supply is superior to the waste. The latter is the state in which sheep usually exist, so as to be profitable to man. The food, however, has two purposes to accomplish; one to support the system, the other to keep it warm. The body, it is well known, is considerably warmer than the surrounding atmosphere, and it preserves a pretty uniform temperature throughout the whole year. To create this high temperature, caloric, the principle of heat, is required, to supply which combustion is necessary; and, strange as it may appear, this combustion is continually going on in the system, and is produced on the one hand by the carbon taken with the food, and on the other by the oxygen imbibed from the atmosphere. These elements uniting, the heat of the body is thereby maintained in much the same manner, though apparently so different, as a candle burns, the carbon being supplied by the grease, and the oxygen by the air; deprive it of either, and the candle is extinguished.

In carnivorous animals the carbon required for the warmth of the system and the respiratory process is supplied chiefly by the waste of the tissues of the body, which waste is considerably greater than in herbivorous animals; but in the latter the greater part so required is supplied by the food itself. In the former, the whole of the food can be converted into flesh; in the latter, a portion only is capable of being thus assimilated. Another considerable part is employed for the production of animal heat, and what is not required for this purpose, for the formation of fat. This, however, can be best shown by the result of the analysis of the structures we are speaking of. Flesh and blood consist of the following elements, subject of course to some variation, and to the water being removed. By supposing the substance to be analysed to consist of 10,000 instead of 100 parts, we avoid having recourse to decimals, which may not be intelligible to everyone:—

	Flesh	Blood
Carbon	5,182	5,195
Hydrogen	757	717
Nitrogen	1,501	1,507
Oxygen	2,137	2,139
Ashes	423	442
	10,000	10,000

By comparing together these two analyses, it will be seen that there is but a trifling difference between the composition of either,

and that the relative proportion of carbon and nitrogen is the same. These are the proportions in which these two elements unite in the tissues of the body; and it is found that the characteristic of muscle or flesh is the possession of nitrogen; and unless food possesses this element, it will not nourish the body. It will be seen that the principal difference between flesh and fat consists in the absence of nitrogen from the latter, as the following analysis of mutton fat will show:—

Carbon	7,900
Hydrogen	1,170
Oxygen	930
	10,000

Thus particular articles of food, such as sugar, starch, gum, oil, or butter, which possess no nitrogen when taken as food, though they will increase the development of fat, will not nourish the flesh; and if animals are confined to this diet alone, they will surely die.

The analysis of hay is the following: 1,162 parts being dried in the air will contain 162 parts of water, which, being deducted, leaves 1,000 parts, which are thus composed:—

Carbon	458
Hydrogen	60
Oxygen	387
Nitrogen	15
Ashes	90
	1,000

Now it is evident, on comparing this analysis with that of the blood, that an animal to make 10 lbs. of the latter must eat 100 lbs. of hay before he acquires sufficient nitrogen to compose it, supposing that the whole is so devoted. By consuming this 100 lbs. of hay, which we will suppose divided into 10,000 parts, he will take 4,580 parts of carbon, whilst not more than 520 parts are required by the blood, leaving 4,060 portions not required for nutrition; there will also be 424 parts of hydrogen unrequired, and 3,656 of oxygen; what, then, becomes of these superfluous elements? Why, they are required principally for the purpose of sustaining the heat of the body; the hydrogen and oxygen unite to form water, and the carbon unites with the oxygen taken by respiration, producing heat by the combustion, and is given off by the lungs in the form of carbonic acid gas. The nutritious portions of the blood are fibrine and albumen, whose elements are almost exactly the same, and correspond also with the fibrine and albumen found in vegetables. Although nitrogen forms such an essential part of nutritious food, yet it cannot in any way enter

the system or afford nourishment in a simple or uncombined form, but only in such combination as we find in albumen. It is evident, therefore, that to form blood food must be taken which contains albumen, or substances analogous to it, in order to be nutritious, and in proportion to the amount of albumen it possesses will be its nutrient properties. Modern chemists designate food which is thus capable of nourishing as nitrogenised or azotised, from its containing nitrogen; whilst other varieties of food, such as starch, gum, sugar, fat, wine, beer, and spirits, which contain no nitrogen, are denominated carbonaceous or unazotised.

Albumen is thus composed—carbon 550, hydrogen 70, nitrogen 159, and oxygen 221 in 1,000 parts.

Fat, we have seen, differs from flesh in containing no nitrogen, and it is formed therefore from the carbonaceous portion of the food, after sufficient for respiration and warmth has been supplied. Starch, and other similar substances, is also converted into fat by the abstraction of oxygen. Some animals possess a much greater capability of acquiring fat than others. Sheep possess this quality in a high degree, and, with their inactive habits, the formation of fat undoubtedly wards off disease by affording an employment for the large amount of unazotised food consumed. Young animals make but little fat; their digestive organs, and indeed the whole vital system, is fully demanded in increasing the size of the flesh or muscles, and consequently we find that lambs take a much greater amount of exercise than their dams. Their breathing being thus increased, more oxygen is consumed, more carbon given out; and their animal heat is thus kept up, which in them is doubly necessary from the little protection the mothers afford, and from their being dropped at a cold period of the year. The milk of sheep contains a much greater proportion of nitrogenised matters than does the food partaken, and thus is so well calculated to increase the flesh.

The following shows its analytical composition:—

	Cow	Ass
Cassein	40	19
Butter	46	13
Sugar	38	63
Ashes	6	
Water	890	905
	1,000	1,000

Cassein is here the only nitrogenised substance; it is the principle ingredient of cheese, which usually consists of that and butter, and it very nearly resembles albumen, into which it can be readily converted in the system. The butter and the sugar are

the carbonaceous constituents required for respiration, and the ashes contain phosphate of lime and common salt.

Cassein is more easily digested than any other substance, and being, as it were, ready formed albumen, the weak digestive power of the young animal is thus relieved from the necessity of separating or forming it. We have seen that the use of the carbonaceous portion of the food is to keep up the temperature of the body by uniting with the oxygen of the atmosphere, and also to produce fat; and we shall see by the following tables that the usual food of sheep abounds very considerably with the carbonised constituents.

	Water	Organic matters	Ashes
100 lbs. of Hay contain . . .	16	$76\frac{1}{2}$	$7\frac{1}{2}$
„ Turnips	89	10	1
„ Swedes	85	14	1
„ White Carrots . .	87	12	1
„ Peas	16	$80\frac{1}{2}$	$3\frac{1}{2}$
„ Oats	18	79	3

The organic matters thus separated are found to consist of the following proportions:—

	Albumen	Unazotised matters
Hay	8	$68\frac{1}{2}$
Turnips	1	9
Carrots	2	10
Oats	$10\frac{1}{2}$	68
Peas	29	$51\frac{1}{2}$

We subjoin a table showing the composition of various foods used for sheep at the present time, and which will serve as a useful guide to graziers, enabling them to ascertain from time to time the best and cheapest combination for fatting purposes:—

Analysis of Articles Used as Food for Sheep.

	Water	Woody-fibre	Starch, Gum, Sugar	Albu-men	atty atter	Ash
Beans	14·6	10·0	46·0	24·0	2·0	3·4
Peas	14·0	10·0	48·0	23·4	2·0	2·5
Barley	13·2	13·7	56·5	13·0	0·3	3·3
Wheat	14·6	12·4	57·0	12·7	0·9	2·4
Oats	10·8	20·8	46·5	13·6	5·0	3·3
Meadow hay . . .	14·0	30·0	40·0	7·1	2·5	5·1
Clover hay . . .	14·0	25·0	40 0	9·3	3·0	0·9
Rape cake	11·4	17·1	23·1	29·0	11·4	8·0
Linseed cake . . .	13·4	14·0	27·4	27·3	11·9	6·0
Linseed	10·0	10·5	20·5	20·5	34·0	4·5
Cotton cake . . .	11·3	21·2	31·0	23·7	6·2	6·5

Analysis of Articles used as Food for Sheep—(continued).

	Water	Woody-fibre	Starch, Gum, Sugar	Albu-men	Fatty matter	Ash
Decorticated Cotton cake .	8·3	9·0	17·4	41·0	16·0	8·0
,, Earth Nut cake	11·0	4·5	31·0	40·0	7·0	6·0
Maize	14·96	5·02	60·98	11·27	6·5	1·24
Locust beans . . .	14·22	3·88	71·48	7·72	0·96	1·74
Mangold	86·1	2·0	8·9	1·8	0·2	1·0
Swedes	89·0	3·8	4·7	1·5	0·3	0·7
Turnips	90·3	3·1	4·5	1·2	0·2	0·7
Carrots	86·2	3·0	8·6	1·5	0·4	0·8
Kohl Rabi . . .	86·74	0·77	8·60	2·75	0·2	1·12

These tables are very useful as exhibiting the amount o azotised constituents in the food, and also as regards the quantity of non-azotised matters, either employed in respiration or in forming fat or assisting in nourishing the body. It cannot be supposed that 100 lbs. of hay will furnish as much carbon for respiration or for fat as seven or eight times this quantity of turnips; undoubtedly much of the hay is excreted as vegetable fibre in the fæces in an unchanged state. These theoretical facts, therefore, highly valuable as they are and are likely to be, must be tested and proved by practical experiment in order to render them useful in the feeding of animals. And here it will be both proper and profitable to contrast the foregoing tables with others deducted from the basis of practical experiment. The first is translated by the late Rev. W. Rham, from the French, and is the mean of the result of the experiments made by some of the most eminent agriculturists of Europe in the actual feeding of cattle:—'Allowance must be made,' observes Mr. Rham, 'for the different qualities of the same food on different soils and in different seasons. In very dry summers the same weight of any green food will be much more nourishing than in a dripping season. So likewise any fodder raised on a rich dry soil will be more nourishing than on a poor wet one. The standard of comparison is the best upland meadow-hay, cut as the flower expands, and properly made and stacked, without much heating: in short, hay of the best quality. With respect to hay, such is the difference in value that if 100 lbs. of the best is used it will require 120 lbs. of a second quality to keep up the same stock, as well as 140 lbs. of the third, and so on till very coarse and hard hay, not well made, will only be of half the value, and not so fit for cows or store cattle, even when given in double the quantity. While good hay

alone will fatten cattle, inferior hay will not do so without other and richer food.

I shall give the table as it stands :—

	lbs.	
Good hay	100	is equal in nourishment to :—
Clover hay	90	made when the blossom is completely developed.
Sainfoin hay	89	
Green clover	410	
Vetches or tares, green	457	
Shelter wheat-straw	374	
Oat-straw	195	
Peas-haulm	153	
Mangold-wurzel	339	
Turnips	504	
Carrots	276	
Swedish turnips	308	
Wheat	45	
Barley	54	
Oats	59	
Peas and beans	45	
Wheat-bran	105	

On the Feeding of Animals.—A certain quantity of food is required to keep the animal alive and in health: this is called its necessary ration of food: if it has more it will gain flesh, or give milk or wool.

An ox requires 2 per cent. of his live weight in hay per day; if he works, he requires $2\frac{1}{2}$ per cent.: a milch cow, 3 per cent.: a fatting ox, 5 per cent. at first; $4\frac{1}{2}$ per cent. when half fat; and only 4 per cent. when fat; or $4\frac{1}{2}$ on the average. Sheep grown up take $3\frac{1}{3}$ per cent. of their weight in hay per day, to keep in store condition.

Growing animals should never be stinted.

On this subject there is an excellent article by Mr. Hyett, in the fourth volume of the Journal of the 'Royal Agricultural Society of England.'

Quietude and warmth greatly contribute to the fattening process. This is a fact which has not only been developed by science, but proved by actual practice. The manner in which these agents operate are simple and easily explained :—Motion increases respiration, and the excess of oxygen thus taken requires an increased quantity of carbon, which would otherwise be expended in producing fat. So likewise cold robs the system of animal heat, to supply which more oxygen and more carbon must be employed in producing extra combustion, to restore the diminution of temperature. Nature enforces this restoration of warmth by causing cold

to produce both hunger and the disposition for motion, supplying carbon by the gratification of the former, and oxygen by the indulgence of the latter. The above facts are illustrated by the following experiment of the late Lord Ducie:—

One hundred sheep were placed in a shed, and ate 20 lbs. of Swedes each per day, whilst another hundred, in the open air, ate 25 lbs., and at the end of a certain period the former animals weighed 3 lbs. more than the latter, plainly showing that, to a certain extent, warmth is a substitute for food. This was also proved by the same nobleman in other experiments, which also illustrated the effect of exercise:—No. 1. Five sheep were fed in the open air, between November 21 and December 1; they consumed 90 lbs. of food per day, the temperature being about 44°; at the end of this time they weighed 2 lbs. less than when first exposed. No. 2. Five sheep were placed under shelter, and allowed to run at a temperature of 49°; they consumed at first 82 lbs., then 70lbs. per day, and increased in weight 23 lbs. No. 3. Five sheep were placed in the same shed, but not allowed any exercise; they ate at first 64 lbs., then 58 lbs., and increased in weight 30 lbs. No. 4. Five sheep were kept in the dark, quiet and covered; they ate 35 lbs. per day, and increased in weight 8 lbs.

A similar experiment was tried by Mr. Childers, M.P., and is thus related by that gentleman in the 'Journal of the Royal Agricultural Society of England.' He says:—'I last winter enclosed a small yard with posts and rails, and erected a low thatched shed, just large enough to allow a score of sheep to lie down at once. The floor of this shed was boarded with common rough slabs, and was raised eighteen inches above the surface of the ground, the boards being placed three-eighths of an inch apart, in order to allow the free passage of water and to keep the boards dry, as my great fear was that the sheep might get the foot-rot.

'I then proceeded, on January 1, to draw forty wether hogs out of my flock of Leicesters, and divided them into two lots, as equal in quality as I could get them. On weighing each sheep separately, I found the weight of one score to be 183 stone 3 lbs., and that of the other 184 stone 4 lbs. I put the first lot into the yard, and placed the other lot on turnips. The field was a dry sandy soil, well sheltered, and peculiarly favourable and healthy for sheep. Each lot had exactly the same quantity of food given them, which was as follows:—

'1st. As many cut turnips as they could eat, which was about 27 stone per day for each lot, or nearly 19 lbs. each.

'2nd. Ten lbs. of linseed-cake, at the rate of half a pound per sheep per day.

'3rd. Half a pint of barley per sheep per day.

'4th. A little hay and a constant supply of salt.

'For the first three weeks both lots consumed equal portions of food; but in the fourth week there was a falling off in the consumption of the hogs in the shed of 3 stone of turnips per day; and in the ninth week there was a falling off of 2 stone more; of linseed-cake there was also a falling off of 3 lbs. per day. The hogs in the field consumed the same quantity of food from first to last. The result of the experiment is as follows:—

	20 shed hogs st. lbs.	Increase st. lbs.	20 field hogs st. lbs.	Increase st. lbs.
January 1	183 3		184 4	
February 1	205 0	21 11	199 9	15 4
March 1	215 10	10 10	208 2	8 8
April 1	239 9	23 13	220 12	12 10
Total increase		56 6		36 8
		(Or 3 lbs. each per week.)		(Or under 2 lbs. per week.)

Consequently the sheep in the shed, though they consumed nearly one-fifth less food, made above one-third greater progress.'

The result of these important and valuable experiments is precisely what we should expect from theoretical reasoning on the principles of the subject. It shows the pecuniary advantage of attending to the comforts of sheep and other animals, the expediency of providing proper sheds, affording shelter when the weather is severe, and lessening their exercise.

The various inorganic constituents of food are of much importance. The soda is required to form the bile; iron is necessary for the blood; sulphur and phosphorus for the brain: thus the advantage of a moderate portion of salt is shown; for this being the chloride of sodium, the chlorine is required for the gastric juice, and the soda for the bile.

A considerable quantity of air is taken into the stomach with the food, being contained in the bubbles of the saliva. This appears to be one of the uses of rumination, viz. to supply a sufficiency of oxygen for the purposes of digestion; and it shows the importance of giving hay or straw with turnips, in order to afford sufficient consistency to the food to adapt it for rumination. Thus chaff should not be cut too short for sheep; but it diminishes the labour of mastication and rumination considerably, and therefore is preferable to hay.

The modern practice of feeding sheep for the butcher consists in forcing them on with corn and oil-cake in addition to turnips. Now, when we consider the high price of the former and the comparative low value of the latter, it at first sight appears very

doubtful whether such a system can be profitable. Beans and oats, which are frequently given, are not less than 1*d.* per lb., and oil-cake about the same price; whilst turnips, even at 10*s.* per ton, are but 6*d.* per cwt., or upwards of 18 lbs. for 1*d.*; and although the single pound of beans contains more albumen than the 18 lbs. of turnips, and will accordingly make more actual muscle or flesh, yet the turnips contain three times the quantity of unazotised substance, or that which may be converted into fat; and the feeding properties of each having been tested by experiment, an equal weight of beans is supposed to be equal to twelve times the quantity of turnips. According to this experiment it would appear that 12 lbs. of turnips contain equal nutriment to one pound of beans, whilst the latter is equivalent in value to 18 lbs. of the former. How, then, can beans be profitable to sheep? To answer this question we must bear in mind that every animal requires a considerable quantity of food to keep it in the same state. A sheep requires nearly three and a half per cent. of its weight in hay to keep it in store condition; but to become fat it requires considerably more, perhaps half as much again if it will take it. So large a quantity being required merely to keep the animal in the same state, it follows that the more rapidly an animal is fattened, the more profitable it must be. For instance, let us suppose that 4 cwt. of hay will keep a sheep in the same state for four months; now if the animal will consume this quantity in three months, then the extra hundredweight will go towards fattening or increasing its size. In the same manner if, by giving corn in addition to turnips, we render the animal as fat in three months as it would otherwise be in six, we shall then save the value of the turnips which would be consumed in the extra three months, which will compensate, or more than do so, for the value of the corn, to say nothing of the greatly increased value of the dung, which, in the case of oil-cake, is reckoned at one-third the cost. The appetite of the sheep is of course daily satisfied by means of turnips—it can take no more of this food; but by giving another description, different in taste, more attractive to the palate, more stimulating, and considerably more nutritious, the animal is induced to take, and enabled to digest it, and thus can make more blood and increase more rapidly in fat. A variety of food operates like cookery in the human subject, enabling more sustenance to be taken.

With respect to the most advantageous food to be given, there is some difference of opinion, some preferring oil-cake, some beans or peas, and others oats or barley. It must of course depend in some measure on the nature of the farm, and the respective cost

of each article of food. Sheep certainly prefer beans to oats; and where the former are grown, they can be undoubtedly used to advantage. They abound in that principle in which turnips are most deficient, and thus are adapted to counteract, in a measure, the too weakening effect of the turnips; and the latter, abounding more in the elements of fat, probably prevent the beans from hardening the flesh too much, which they are otherwise apt to do. Oats and barley are more fattening than beans, but contain less albumen; and linseed-cake is still richer in albumen, and contains also 10 per cent. or more of ready-formed fat or oil. Its cost is rather more, but it is more conducive to health than other food, and its cost may be reduced by the admixture of cotton-cake. Mr. Childers states that sheep fed with the addition of half a pint of barley per sheep per day, half a pound of linseed-cake, a little hay, and with a constant supply of salt, become ready for the butcher in ten weeks, and gain of flesh and tallow 33lbs. to 40lbs. per head (one sheep gained 55 lbs. in twelve weeks); and that with artificial food 30 tons of turnips will feed sixty sheep; while, on the common plan of feeding on turnips alone, out of doors, the average of the country is that 20 tons of turnips will feed in sixteen week ten sheep, with a gain of only 20 lbs. of flesh and tallow. The barley and cake cost 6*d.* to 10*d.* per week for each sheep; and the turnips, with this addition, thus go eight times as far, or produce eight times the amount of flesh and tallow.

Professor Coleman, in his lecture elsewhere alluded to, observes: 'An acre of swedes, 20 tons to the acre, will keep a flock of sheep from 250 to 400 head for a week, each sheep consuming 15 lbs. to 25 lbs. per day, the small South Down sheep taking the smallest, the large Cotswold or Lincoln the largest weight above named. A very great economy is secured in the feeding of sheep on turnips by using the turnip-slicer. Some farmers give all the turnips sliced, but it is recommended that some roots should be left in the ground for the sheep to nibble at when tired, or otherwise disposed. The sliced turnips are given to the sheep in troughs, so arranged as to prevent the sheep from overturning them, or from getting in and dirtying and wasting the food with their feet.'

The lecturer then proceeds to point out that, by altering the system of sheep-feeding, a larger produce per acre may be obtained. 'The point, then,' he says, 'to which I would draw your attention is to a more economical system of feeding sheep, especially breeding sheep, so as to increase and at the same time leave the land in better condition for corn. This result would,

I believe, be effected by reducing the quantity of roots and using more dry food, such as straw, in combination with a small quantity of artificial food, which will act as a stimulus to digestion.

It is surprising what a large quantity of straw may thus be consumed, with what a small quantity of turnips the ewes will thrive, and what a rare manure-heap results, which is close at hand to be spread on the young seeds the following autumn, with the minimum amount of labour. A system of this sort is well suited to large-breeding farmers, where the land often lies remote from the buildings, and the consumption of straw in the homestead would greatly increase the labour of carriage to and from the field.

Mr. Scott Burn, in his very useful little work, 'Year-Book of Agricultural Facts,' gives an account of an experiment on feeding sheep of different breeds made by the Parlington Farmers' Club, with the view of testing the feeding properties of different breeds. The result was certainly in favour of the Lincolns, although as a comparative trial it was hardly satisfactory. However the facts brought out, and the total result, were interesting. Altogether there were forty-two sheep, each of which, on the average, consumed 160 lbs. of roots per week, or 23 lbs. per day, and 4 lbs. of linseed-cake or rather more than a $\frac{1}{2}$ lb. per day, and the average of mutton made was 21 lbs. each sheep, or rather less than 1 lb. 10 ounces per week. The average dead weight of each sheep when slaughtered was 107 lbs., the live weight being 191 lbs., or as 7 is to 12·2.

In a lecture given by the Author, before a Farmer's Club, on the Fatting of Animals, the practical and scientific parts of the subject are thus brought together:—'It has been found, then, that it takes something like 150 lbs. of turnips to make 1 lb. of mutton, if fed in the open air; but when housed in sheds, under favourable conditions, 100 lbs. have succeeded in making the same quantity of mutton; therefore 100 lbs. and 150 lbs. may be considered the extremes. I do not mean to say that in all cases 100 lbs., given in sheds, will produce the same effect as 150 lbs. given out of doors, because sometimes those given out of doors will produce a better effect than the others; but it is well known that, in a succession of four or five wet days, the animals make little or no increase. This proportion of 150 lbs. of roots to 1 lb. of mutton is derived from a number of experiments made by different people, and is as near the fact as we can arrive. It is interesting, because it enables us to ascertain what really is the feeding value of a given quantity of roots. Thus, you may put what you like as the price of mutton—6*d.*, 8*d.*, or 10*d.* per pound; and if it takes 150 lbs. of

roots to make 1 lb. of mutton, it will take something like 1 ton or a little less to make 14 lbs. It has been found by accurate observers that sheep will economise food better than the ox. Sheep, if fed on nutritious food, will make $1\frac{3}{4}$ per cent. in live weight, whilst in the ox not more than 1 per cent. is made. In the pig a much greater amount of food is turned into flesh and fat; but then there is this drawback, that we are obliged to keep the pig on much more expensive diet, and it brings the result perhaps pretty nearly the same.

'In some other experiments it has been proved that to make 100 lbs. of mutton, 170 lbs. of oil-cake and 876 lbs. of swedes were used, and linseed was found not to present any more advantages than cake. In a trial between barley and beans, it was found that 1 lb. of barley had as much effect on the animal as 1 lb. of beans; but then, as we have noticed, barley contains a considerable less quantity of nitrogen, a less quantity of nitrogenous matter; and although it proved sufficient for the animal, yet, as nearly all the value of the manure resides in the albuminous matter, it shows at once that the value of that from beans, or cake or other nitrogenous substances, will be double that left behind by barley, oats, or even wheat. It is very important to bear this in mind, because, if as much carbonaceous food can be bought at the same price as so much albuminous food, still it would be more economical to use the nitrogenous because the manure would be more valuable, it being richer in ammonia, which gives the high value to guano and other manures for the corn crops.

'In these experiments it was sought to ascertain the quantity of food required by various kinds of sheep, but this might vary according to the different circumstances to which they are subjected. It was found, then,that the Cotswold required least, next the Leicesters, next a cross-bred, next to them the Hampshire Downs, and then the Sussex Downs, which required the greater quantity of food. The Cotswolds required 802 lbs. of dry substance to make 100 lbs. of flesh, and the Sussex Downs 877 lbs., but the last was the more valuable per pound.'

In the very elaborate experiments instituted by Mr. Lawes at Rothamstead, many interesting facts crop out with regard to the fattening of sheep and other animals, both with relation to the breeds and the result of the food consumed. The following are some of the conclusions arrived at, which may probably be useful to many persons:—

In the carcass of even the store or lean sheep, there was more than one and a half times as much fat as nitrogenous substance; and in that of the store or lean pig there was twice as much.

Of the fatter animals, the carcass of the fat ox contained twice and one-third as much dry fat as nitrogenous substance, that of the fat sheep four times, and that of the very fat sheep even six times as much. Lastly, in the carcass of the moderately fat pig, there was nearly five times as much fatty matter as nitrogenous compounds. In the carcass of sheep we should include that the fat would generally amount to more than three, and frequently to four, or even more, times as much as the nitrogenous matter.

That of the moderately fattened ox contained $45\frac{1}{2}$, of the fat lamb $48\frac{2}{3}$, of the half fat sheep $49\frac{2}{3}$, of the fat sheep $39\frac{2}{3}$, and of the very fat sheep only 33 per cent. of water. Lastly, in the carcass of the moderately fattened pig there was $38\frac{1}{2}$ per cent.

Between the condition in which these particular carcasses were taken for analysis and that in which the meat would be sold by the butcher, from 1 to 2 per cent., or perhaps more, of water would be lost by evaporation.

Food and Increase.—Fattening oxen, fed liberally upon good food, composed of a moderate proportion of cake or corn, some hay or straw-chaff, with roots or other succulent food, and well managed, will, on the average, consume 12 to 13 lbs. of the dry substance of such mixed food per 100 lbs. live weight per week, and should give 1 lb. of increase for 12 to 13 lbs. dry substance so consumed. Sheep fattening under somewhat similar circumstances (but with a less proportion of hay or straw) will consume about 15 lbs. of the dry substance of the mixed food per 100 lbs. live weight per week, and should yield, over a considerable period of time, one part of increase in live weight for about nine parts of the dry substance of their food. If the food be of good quality, oxen and sheep may give a maximum amount of increase for a given amount of total dry substance of food, even provided the latter contain as much as five parts of total non-nitrogenous to one of nitrogenous compounds.

The cereal grains contain on the average rather more than six parts of total non-nitrogenous to one of nitrogenous compounds, and the leguminous seeds often not much more than two parts to one.

Oil-cakes and foreign corn contain rather more than six-sevenths, and home-grown corn, hay, &c., rather less than six-sevenths, of their weight, 'of dry substance.'

Common turnips generally contain about one-twelfth, swedes about one-ninth, mangolds about one-eighth, and potatoes about one-fourth, of their weight, 'of dry substance.'

With as much as five or six parts of total non-nitrogenous to one of nitrogenous compounds in the dry substance of the fatten-

ing food of oxen, sheep, and pigs, the increase will probably be very fat. In the earlier stages of growth and feeding, a lower proportion of total non-nitrogenous to nitrogenous compounds is desirable.

Taking into consideration the cost of the foods, and the higher value of the manure made from those which are rich in nitrogen, it is frequently the most profitable for the farmer to employ—even up to the end of the feeding process—a higher proportion of nitrogenous constituents in his stock foods than is necessary to yield the maximum proportion of increase in live weight for a given amount of dry substance of food.

The Proportion of Parts.—1. In relation to their weight, oxen contain considerably more of stomachs and contents than sheep, and sheep considerably more than pigs; whilst pigs have more of intestines and contents than sheep, and sheep more than oxen. Oxen, sheep, and pigs have nearly equal proportions of the other internal organs; namely, heart and aorta, lungs and windpipe, liver, gall-bladder and contents, and milt or spleen, taken together. They have also nearly equal proportions of blood, but the pig rather the least.

2. In proportion to their weight, sheep yield rather more internal loose fat than oxen, and pigs very much less than either.

3. As oxen, sheep, and pigs mature and fatten, the internal organs increase in actual weight, but they diminish in proportion to the weight of the animal.

4. Of the internal offal parts, the loose fat alone increases both in actual weight and in proportion to the weight of the body, as the animals mature and fatten.

5. As oxen, sheep, and pigs mature and fatten, the total 'offal' increases in actual weight, but diminishes in proportion to the weight of the body; the 'carcasses' increase both in actual weight and in proportion to the weight of the body.

6. Well-bred and moderately-fattened oxen should yield 58 to 60 per cent. carcass in fasted live-weight, whilst excessively fat oxen may yield from 65 to 70 per cent.

Moderately-fattened sheep (shorn) should yield about 58 per cent. carcass in fasted live-weight, and excessively fat sheep may yield 64 per cent., or more.

7. Of the increase over the final six months of liberal feeding of moderately fat (one and a quarter to one and a half year old) sheep, 55 to 70 per cent. may be reckoned as saleable carcass. Of the increase over the final six months of liberal feeding of very fat sheep (one and three-quarters to two years old), 75 to 80 per cent. may be reckoned as saleable carcass. Of the increase

over the final two or three months of liberal feeding of moderately fat pigs, about 90 per cent. (including head and feet) may be reckoned as saleable carcass.

8. When the fattening food of oxen, sheep, and pigs contains less than about five parts of non-nitrogenous to one of nitrogenous compounds, the proportion of gross increase for a given amount of dry substance of the food, will not increase with the increased proportion of nitrogenous compounds, whilst the proportion of carcass to the live-weight will probably be somewhat less, and the carcasses themselves will be somewhat more horny and fleshy, and less fat.

9. The increase of liberally fed sheep, over five or six months of the final fattening period, will probably consist of 75 per cent., or more, of total dry substance, of which sixty-five to seventy parts will be fat, seven to eight parts nitrogenous compounds, and about one and three-quarter parts mineral matter.

Sheep, fattening for the butcher on a good mixed diet, will seldom carry off more than 3 per cent. of the consumed mineral matter. The exact proportion will depend very much on the proportion of the mineral matter to the digestible organic constituents of the food. They will probably carry off less than 5 per cent of the consumed nitrogen, if the food be comparatively rich, and more than 5 per cent. if it be comparatively poor in nitrogen. They should store up about ten parts of fat for every 100 parts of non-nitrogenous substance consumed.

Sheep, fattening for the butcher on a good mixed diet, should give about nine parts dry increase—consisting of about eight parts fat, 0·8 to 0·9 part nitrogenous substance, and about 0·2 part mineral matter—for 100 parts dry substance consumed. More than ninety parts of the consumed dry substance are, therefore, expired, perspired, or voided.

The proportion of the stomachs and their contents constitute in the oxen about $11\frac{1}{2}$, in the sheep about $7\frac{1}{2}$, and in the pig only about $1\frac{1}{4}$ per cent. of the entire weight of the body. The proportion of the intestines and other contents stand in the opposite relation.

Thus, they amount to about $6\frac{1}{4}$ per cent. in the pig, to about $3\frac{1}{2}$ per cent. in the sheep, and to only about $2\frac{3}{4}$ per cent. in the oxen.

Taking together stomachs, small intestines, large intestines, and their respective contents, the entire bodies of oxen yield an average of rather more than 14 per cent., in the sheep a little more than 11 per cent., and in pigs about $7\frac{1}{2}$ per cent.

With this great variation in the proportion of the receptacles and first laboratories of the food, with their contents, the farther

elaborating organs (if we may so call them) with their fluids, appear to be much more equal in their proportion in the three cases.

Thus, the average actual weights per head of the collective stomachs and intestines, and their contents, increased from about $13\frac{3}{4}$ lbs. in five store or lean sheep, to about $15\frac{3}{4}$ lbs. in 100 fat sheep, and to about $16\frac{1}{4}$ lbs. among 45 very fat ewes. Again, the heart and aorta, the lungs and windpipe, the liver, the gall-bladder and contents, the pancreas (sweetbread), the milt or spleen, and the blood, all taken together, give an average actual weight per head—for the five store sheep of $7\frac{3}{4}$ lbs., for the 100 fat ones of $11\frac{3}{4}$ lbs., and for the forty-five very fat ones of $12\frac{1}{2}$ lbs. The rate of increase in actual weight as the animals fatten is, therefore, rather greater for these last-mentioned organs or parts than for the collective stomachs and intestines and contents.

Still they decrease—though not so much as the collective stomachs, &c.—in percentage to the whole body with the increase in weight and fatness of the animals.

Thus the percentage of the heart and other parts above classed with it is, for the average of the five store sheep 8·44, for that of the hundred fat ones 7·71, and for that of forty-five very fat ones 6·55.

Calculations of a similar kind in regard to pigs, show that of their increase during the last two or three months of liberal feeding, little less than 90 per cent. (including head and feet) may be reckoned as saleable carcass.

Again, the mean percentage of loose fat (caul, intestinal, and heart together) in the fat sheep, as slaughtered, was only 6·03; but the percentage in the increase from the store to the fat condition would be 8·91. In the same way, though the average percentage of loose fat in the very fat sheep was only 7·44, the percentage in the increase from the fat to the very fat condition would be 12·17.

The entire body of the store sheep contained nearly 19 per cent. of fat, or more than either of solid matter, and that of the half fat old sheep about $23\frac{1}{4}$ per cent. or more than $1\frac{1}{2}$ times as much as of dry nitrogenous substance.

Of animals fit for the butcher, the entire body of the fat ox contained rather more, and that of the fat lamb rather less, than 30 per cent. of fat; that of the fat sheep $35\frac{1}{2}$ per cent.; that of the very fat sheep $45\frac{2}{3}$ per cent., and that of the fat pig 42 per cent.

Of the animals ripe for the butcher an ox contained rather more than twice as much, a moderately fat sheep nearly three times as much, and a very fat sheep rather more than four times as much dry fat, as dry nitrogenous substance.

PART III.—THE DISEASES OF THE SHEEP.

GENERAL OBSERVATIONS ON THE DISEASES OF SHEEP.

The diseases of the sheep, though numerous, and often fatal, are powerfully influenced by the nature, habits, and constitution of the animal. If we were to judge of the symptoms of disease in the sheep, and regulate our treatment by comparing them with the maladies of such an animal as the horse, our theory and practice would be alike erroneous and unsuccessful. The sheep has very powerful digestive organs, a greater capability than any other domestic animal of converting grass and roots into flesh and fat, and of extracting from coarse and comparatively unnutritious food the nutriment which there exists in a very diffused state. If an unlimited quantity of turnips and hay were given to a horse exposed to cold, he would probably lose flesh instead of gaining it; whilst a sheep, on such food, increases daily in bulk. The brain of the sheep is small, its intellect weak, and its whole nervous system feebly developed, and much of the nervous energy actually possessed is devoted to the digestive organs. The muscular system is comparatively weak, and the sheep is unfitted for laborious exercise even in a state of nature, and this disposition is increased in a tenfold degree in the domestic animal, by the system of breeding adopted, the nature of the food bestowed, and the habits of inactivity and quietude artificially induced. With a weak muscular development we may anticipate what in reality we find, that the vascular system is more feeble than in many animals, and the blood circulating throughout the body is in fact considerably less in proportion to the weight of the body than in the horse. The latter is an animal both able and willing to perform considerable muscular exertion, and is often called upon for it. This exertion is never performed without a waste of the muscular tissue, to furnish which a constant and copious supply of nutritious blood is requisite. In sheep these exertions are not called for, and there is comparatively but little waste of the system; so large a

supply, or rather reservoir, of blood is not therefore required; and although a large amount is actually made from the great quantity of food consumed by the sheep, yet this blood is quickly converted into flesh, and but a comparatively small portion remains as blood in the system. The pathological effect of a weak vascular system, and a freedom from the consequences of severe muscular exertion, is the comparative immunity of the sheep from diseases of an active inflammatory nature. The character of the greater portion of its maladies is consequently that of debility. This indisposition to inflammatory disease is likewise assisted by the great powers of assimilation possessed by the sheep, nutritious food being so quickly and readily converted into flesh and fat. If the horse were fed with food as nutritious and as copious as is often given to fattening sheep, and like it debarred from exercise, disease would very soon be the consequence, whilst the sheep can live on from month to month in confined sheds, taking as much of the most nutritious food as the appetite will permit. The superabundant blood that in the horse would cause plethora and inflammation, in the sheep is quickly converted into flesh and fat.

In the *treatment* of its maladies we must, therefore, bear in mind the peculiar physiology of the animal; and even if a disease be of an inflammatory nature, we must not forget that a sheep does not possess above four to five pounds of blood, whilst most animals have a considerably greater quantity in proportion to their bulk.

The nervous system of sheep, we have said, is comparatively feeble, and we find, that though not exempt from diseases of the brain and nerves, they are nearly always of a debilitating character, such as palsy; whilst those of irritation, as tetanus, spasm, &c., are extremely rare. Thus we find that most of the severe diseases of the sheep are distinguished by a want of tone, and in general this animal quickly sinks under the attack of morbid agents.

The digestive apparatus forms so very important and pre-eminent a feature in the animal economy of sheep, consisting as it does of a variety of complex parts for the elaboration of the food which do not exist in many other animals, that we cannot be surprised that its organs should be those most susceptible to disease. Accordingly we find that such is the case—that the diseases of the digestive organs are frequent, and both of a mechanical and chemical nature. We have those arising from a superabundance as well as a deficiency of aliment, from its too great dryness or too great moisture, from its being too young and luxuriant, or from being too old and withered, from containing unwholesome or poisonous principles, or the minute and invisible eggs of innumerable insects.

Thus we find that diseases connected with the digestive organs are more numerous or more frequent than all the others to which sheep are liable.

Sheep are exposed throughout the year to the vicissitudes of the weather, from the effects of which they are in great measure protected by their woolly coverings; but standing sometimes on a cold and wet soil, and anon on a dry and warm surface, they are subject to the injuries arising from these alternations, and from the effects of standing for a long time on a wet surface, and the reaction which afterwards succeeds from evaporation: diseases of the feet are therefore not unfrequent.

Again, from the same exposure they are subject to the attack of flies and other vermin, which, particularly in the summer months, prove a source of great annoyance, and require constant supervision on the part of the shepherd.

To these morbid causes may be added the circumstances of sheep being kept together often in large flocks, and thus more exposed to the influence of infectious diseases than animals in a more isolated state.

Such are the principal circumstances to which sheep are subjected, and which furnish the causes of their principal diseases; and it is useful to keep in mind the nature of these causes, as well as the peculiarities and constitutional idiosyncrasies of the animals, whilst proceeding to treat separately of their different diseases.

In consequence of the weaker development of the vascular and nervous systems of the sheep, blood-letting is less frequently called for, and should be more moderately employed than in the horse, whilst on the other hand cordial, stomachic and stimulating medicines, are much more frequently demanded; and from the large size of the stomach of the sheep, these medicines may be administered in much stronger comparative doses.

Purgatives are a class of medicines often called for in the treatment of the diseases of the sheep. Not only are the stomachs very frequently diseased themselves, but morbid action is rarely set up in the system without disturbing in some degree the functions of these organs, and rendering the employment of purgatives desirable. And from the vast amount of surface occupied by the stomachs, and the comparative insensibility of a great portion of this surface, there is not that danger in their administration which there is with horses suffering from affections of the chest. In fact purgatives afford us the best means of reducing fever, lowering inflammatory action, and restoring the tone of the digestive organs. In the horse it is the usual custom to administer physic in a solid

form, but in sheep it is desirable that it should be given as a liquid, otherwise it would enter the rumen and there remain an indefinite time, producing an uncertain effect, or perhaps none at all. Given as a liquid it may either all, or only in part, enter the rumen, or the whole may pass at once into the fourth stomach. But in any case it does not very long remain in the rumen, but is soon passed onwards. The neutral salts, particularly the sulphate of magnesia, and linseed oil, form the most suitable purgatives for sheep.

The good effects of purgatives are greatly assisted by the combination of stomachics and cordials: they gently stimulate the coats of the stomach and counteract that tendency which they have (particularly the maniplus) to lose their tone and become palsied when the system is affected by morbid action. They are rendered the more necessary either alone or in combination, in consequence of the feebleness of the nervous system.

Blood-letting in the sheep would no doubt be much abused were it not for the fact that from the mode in which it is practised the quantity is rarely sufficient to do either much good or much injury. The veins under the eye or the ear are most usually selected, and the inside of the arm is a convenient situation; but if a large quantity is really required, the neck is the readiest and most suitable place for the operation. A little wool should be cut off, and the jugular vein made to rise by pressure with the finger, and the vein opened either with a lancet or fleam. The quantity taken must of course be regulated by circumstances, and may range from one ounce to half a pound. It is useless to take less than the former, and rarely prudent to abstract more than the latter quantity.

Since the first edition of this work was published it has become customary with pathologists to class certain maladies, as blood-diseases, or blood-poisoning, and the theory indicated wil certainly best explain the characteristics of some severe and fatal diseases, the post-mortem appearances of which scarcely correspond with the severity of the symptoms or the fatality of the results. Thus in that disease which often attacks young sheep in the spring, when allowed to feed on roots whilst there is a hoar frost on the leaves, the appearance after death showing an effusion of bloody serum in the abdomen, it is considered as a disease of the blood, and the colour of the effusion to be owing to the red corpuscules of the blood having burst their envelopments.

Then, again, there is what has been termed *Splenic Apoplexy*, from the spleen being found after death greatly increased in size and engorged with blood. Professor Simonds considers this, however, to be rather an effect of the disease than a cause, which

he believes to be found in the morbid state of the blood itself, and produced by deleterious agents in the water or the plants growing on certain soils, such as the tart lands of Somersetshire.

Blackleg and redwater in cattle are considered as blood diseases, and so likewise is rheumatism, in which this fluid is principally affected; and although the symptoms are manifested in the loins, back, and different parts of the body, the disease is owing to a preponderance of acid matters in the blood.

It is well to add that since the former editions of this work appeared a number of apparently obscure diseases affecting sheep have found their solution—through the aid of the microscope in the hands of foreign and English observers—in the existence of a great variety of parasities and entozoa, whose natural history and extraordinary changes have been revealed by science. Amongst English observers we may mention the names of Professors Cobbold and Simonds, and also Dr. E. Crisp, the latter being the author of the prize essay on the 'Lamb Disease' offered by the Bath and West of England Society, in the pages of whose journal it appears in 1853.

The list of modern helminthologists is by no means exhausted with the mention of these names; and their investigations have been greatly aided by practical veterinary surgeons, whose contributions would no doubt have been greater had they received some reward or encouragement. Scientific men appear sometimes to forget that other labourers may be working on the same field as themselves, and that their discoveries might be made and revealed unknown to their fellow-workers.

DISEASES OF THE BRAIN.

Turn-sick, Giddiness, &c.—This disease receives a variety of denominations in different localities, such as *sturdy-gig giddiness, goggles, turn, blob-whirl,* &c., most of them derived from the symptoms that are present; but it has been correctly ascertained that in all cases it is owing to one or more hydatids on or in the brain, the pressure of which causes the strange symptoms that are observed. These symptoms are a dull, moping appearance, the sheep separating from the flock, a wandering and blue appearance of the eye, and sometimes partial or total blindness; the sheep appears unsteady in its walk, and sometimes stops suddenly and falls down, at others gallops across the field, and after the disease has existed for some time will almost constantly move round in a circle—there seems, indeed, to be an aberration of the intellect of the animal. These symptoms, though rarely all present in the

same subject, are yet sufficiently marked to prevent the disease being mistaken for any other. On examining the brain of sturdied sheep, we find, as before observed, what appears to be a watery bladder, termed hydatid, which may be either small or of the size of a hen's egg. This hydatid, one of the class of entozoons, has been named by naturalists the *Hydatis polycephalus cerebralis*, which signifies the *many-headed hydatid of the brain*; these heads are irregularly distributed on the surface of the bladder, and on the front part of each head there is a mouth surrounded by minute sharp hooks within a ring of sucking discs. These discs serve as the means of attachment by forming a vacuum, and bringing the mouth in contact with the surface, and thus by the aid of the hooks the parasite is nourished. The coats of the hydatid are disposed in several layers, one of which appears to possess a muscular power. These facts are developed by the microscope, which also discovers numerous little bodies adhering to the internal membrane. The fluid in the bladder is usually clear, but occasionally turbid, and then it has been found to contain a number of minute worms.

The manner in which these hydatids are produced and become present in the brain is no longer a matter of uncertainty, since the investigations of Professor Cobbold and Simonds. Sometimes hydatids are so numerous and extensive as to cause the absorption of a great portion of the brain. The situation of the hydatid is not always the same; sometimes it is found on the surface immediately under the membrane of the brain, at others in one of the hemispheres, or in the substance of the brain; and sometimes, though rarely, in the cerebellum. It is stated that if the animal moves in a circle the hydatid will be found on the side towards which he moves, and probably in the ventricle. If the sheep sometimes makes a circle in one direction and sometimes in another, we may conclude that there is a hydatid in each hemisphere; and when the animal depresses the head and moves straightforward, stumbling against everything in the way, it is probable that the hydatid is about the middle or division of the brain; and if the sheep throws up its head, has a reeling motion, but yet moves onwards, it is supposed that the hydatid is in the cerebellum, or the fourth ventricle.

The French term the sheep either the *turner*, the *trotter*, or the *sailor*, according to the manner in which it moves.

In the majority of cases there is more than one hydatid, often three or four, either together or in different portions of the brain, thus accounting for the frequent failure which attends the treatment. This disease is principally confined to young sheep, and to the first year, though existing not unfrequently in the second; so

that on the Continent they, in some places, avoid it, by keeping the sheep in houses or sheds during the first year, which it is stated prevents the disease. It is much more common on the Continent, and particularly in France, than in England; and it has been supposed that in the former country it destroys nearly a million annually, and in Germany upwards of two per cent.

This disease is considered to be more prevalent in wet undrained soils than in high and dry pastures, and by some it has been attributed, though with little justice, to the practice of breeding in and in; this could only be true when the flock thus bred is predisposed to this disease, for in sheep not so predisposed in-and-in breeding would be likely to keep them free from it.

A further research in natural history has shown that the hydatid and the tape-worm is the same creature in different states of development, and that one will become the other, and *vice versâ.*

Various plans have been recommended for the treatment of this disease, and from the success of each in a few cases, it has for a time been thought a certain cure, and has thus disappointed the expectations excited by partial success. It has been found that when giddy sheep have been rallied by dogs, driven violently, or otherwise used with roughness, in a few instances the symptoms have left them, which has been owing to the rupture of the hydatid by this violence. In some cases the ears have been violently pulled, and then cut off; and in a few instances this has succeeded. A repetition of this treatment in other cases has failed in nineteen cases out of twenty.

Mr. Hogg, the Ettrick Shepherd, states that he has cured many by pushing a wire up the nostrils and through the brain, so as to puncture the hydatid; and his advice is to feel for the soft place in the skull, and bring the point of the wire just under it. The hydatid, if thus penetrated, will be discharged through the nostrils. If the wire is carried too low, it will injure the sensible portion of the brain, and the animal will either die suddenly, or after enduring much agony. The operation, therefore, is hazardous, uncertain, and cruel, depending so much on the situation and number of the hydatids.

Trephining has been employed successfully in many instances; and, amongst others, the late Sir Astley Cooper kept a sheep many years which he had thus cured. A portion of the skull is separated by means of a small circular saw, and then raised; and if the hydatid should be under, and there should be none elsewhere, the operation will probably succeed. There is danger of inflammation of the brain, and the number of failures has greatly preponderated over the cures.

Perhaps the best, as it is certainly the simplest, mode of treatment, consists in feeling for a soft place; and if found, penetrating the hydatid by means of a small awl. A small syringe may be also used to pump out the contents of the hydatid. A very convenient apparatus is now supplied, by which the operation can be readily performed. Mr. Greaves, of Bakewell, Derbyshire, states, in the first volume of the 'Journal of the Royal Agricultural Society of England:'—'The easiest and most effectual way, not only to cure it, but to prevent its progress, is to take some common tar, and place it between the eyes of all the sheep, spreading it down to the nose, and it is astonishing to find how soon they recover; nor will any of the other sheep, having the tar applied in this manner, be liable to have the complaint.'

We give the above observation, in order that any one who chooses may try this curious mode of procedure in this desperate complaint. The natural history of the hydatid will be given more fully further on.

Water on the Brain (Hydrocephalus).—Besides the disease just spoken of, the lamb is subject to water on the brain (*hydrocephalus*). It sometimes exists before birth, and the size of the head prevents delivery; and in order to save the ewe, it is necessary to destroy the lamb by penetrating the skull, so as to let the accumulated water escape. The water may be either in the ventricles or under the membranes, and it occasions a stupid appearance and staggering gait, but no circular motion: the head is frequently enlarged.

Nothing can be done in the way of treatment, but it will be prudent not to breed again from the ewe; and if there are many such cases, the ram, too, may be changed with advantage; for it is evident that the disease is owing to some constitutional fault in the parents, or mismanagement during uterogestation.

Apoplexy.—The brain is liable to two other diseases, apoplexy and inflammation. Though the former will often produce the latter, yet it is a different disease, as it consists in determination of blood to the head, and distention of its vessels. Both diseases may be attributed to the same cause—that is, a redundancy of blood in the system, arising from the forcing plan frequently adopted, or a sudden change from very poor to very rich pastures. The Leicester sheep, from their propensity to make flesh and fat, are more liable to apoplexy than others. The attack is usually sudden: the sheep stands still or moves forward unconscious; its eyes are dilated and prominent, and sometimes it is almost or quite blind. The membrane of the nostrils and the eyelids are full of blood, and of a deep red or violet colour. If not relieved, the

sheep will reel and fall, and die in less than half an hour, or the disease will terminate in inflammation of the brain.

These symptoms are produced by the pressure of the blood on the base of the brain. The animal being in a state of plethora, every part of the body abounds with blood; but the brain being confined by an unyielding case, unlike other parts of the body, receives the injury, and sometimes a rupture of its vessels takes place.

Inflammation of the Brain (Phrenitis).—Inflammation of the brain may be owing to the same causes as apoplexy, but it consists in a greater activity of the vessels of the brain, and its symptoms are not so lethargic, but more violent. The animals appear frantic, throwing themselves about with great violence; and in lambs their motions are quite ridiculous, and have in consequence, among the ignorant, given origin to the idea of their being bewitched. The treatment in both diseases must be very prompt, and consists principally in active bleeding and purging. A pound of blood, or as much as the sheep can bear, should be abstracted from the jugular vein, and two or three ounces of salts administered; in the lamb half this dose will be sufficient.

In vol. viii. of the 'Veterinarian' Mr. Tait relates some cases which appear to be bordering between inflammation and apoplexy. He says:—'Some time ago I was requested to look at a flock of sheep belonging to a farmer in Forfarshire. Upon inquiry I found that the sheep, owing to the dry season (1826), had been considerably stinted in their food in the summer-time, and that they had been, about a month before I saw them, staked in a field of very fine turnips. The appearance of the sheep was rather strange; for about a minute they appeared quite dull, and then all at once became quite frantic, dashing themselves on the ground and running at every person within their reach; others would all at once spring from the ground and fall down and die. I caught one and bled her copiously, which seemed to relieve her much. I then gave her a dose of Epsom salts, which in a few days produced a cure, and by such simple treatment many of the sheep recovered.

'On examining those that died, they invariably presented the following appearances:—On opening the abdomen the peritoneal covering of the bowels appeared more vascular than in its natural state, and there were some black spots on the mucous membrane of the small intestines. The lungs were very much congested. On opening the cranium I found the vessels of the brain turgid and almost in a bursting state; and, in fact, in some cases rupture had actually taken place, for there was an effusion of blood on the surface of the brain.

'The flock was immediately remov d from the turnip-field, and turnips were given to them more sparingly, which soon put a stop to the epidemic, if I may so term it.'

Louping-ill.—Analogous to the diseases just described, if not altogether the same, is what has been termed the *Louping-ill*, of which there is a very good description by an intelligent agriculturist (Mr. Fair) in the eighth volume of the 'Veterinarian.' Mr. Hogg also describes the disease under the terms *thwartil-ill*, *trembling* or *leaping-ill*. It seems more peculiar, as an epidemic, to North Britain than to England, for in the latter country it has not been described by any writer.

We will first give Mr. Fair's account, which is well worth transcription :—

'On the animal's being slightly attacked there is an evident falling off in condition, and a dull, heavy appearance, with deadness of coat. There is a loss of power in one or more limbs, and sometimes of a whole side, or even the whole of the animal, as if struck with palsy or tenanus, of both which diseases, as well as apoplexy, it seems to participate in no slight degree ; the head and neck being more or less frequently, according to the violence of the attack, convulsively or spasmodically contracted or drawn towards the shoulder or back, with a violent tremor and constriction of the œsophagus, so as to endanger suffocation when any liquid, however small the quantity, is attempted to be conveyed into the stomach. This is also much retarded, or prevented from being accomplished, by a convulsive and spasmodic locking of the jaw, a frothy saliva being at the same time emitted from the mouth, more especially when the convulsive fits have come on, which, in severe cases, frequently takes place from once to twice every five minutes, accompanied by a very laborious and quick respiration. The hurried breathing, however, subsides altogether as soon as the fit has terminated.

'In this state the animal will remain for hours or days, and if he does not rally from it, death, sooner or later, ensues. When sheep affected with louping-ill have once taken the ground, we should have recourse to the knife as the only means of putting an end to their sufferings.

'Some few instances, however, have occured among my flock, when they have most unexpectedly recovered; and in other cases they have for a length of time dragged a seemingly powerless hind leg behind them, and the left leg oftener than the right one. When this, however, takes place, the limb still remains cold and dead for a time, in despite of the use of friction or stimulants. If it is a fore leg it is not uncommon, after the sheep gets on its feet again,

for a tumour, of the size of a pigeon s or even of a hen's egg, filled with pus or ichor, to appear. On being punctured it presently subsides and is lost. These abscesses usually appear in the neighbourhood of the joints, but sometimes about the arms, the brisket, or any neighbouring part of the body. Other symptoms of this disease are a wild, excited appearance on being approached by man, dog, or any other animal, and even by one of their own species; a champing or gnashing of the teeth, and foaming at the mouth while yet on their legs, accompanied by vertigo and delirium, also the assuming of a rotatory or sidelong motion. When these last symptoms, which are those of apoplexy, or determination of blood to the head, are seen, I have restored the animal to perfect health by opening the two veins at the inner angles of the eyes, whence a copious discharge of blood may be effected; but this can only be done with advantage when the case is taken in time. Venesection is highly injurious if performed after the sheep has entered into the collapsed state of the disease, although shepherds frequently bleed promiscuously, and thereby destroy their patient, when tonics and suitable aliment, as warm milk or thin flour gruel in a tepid state, would be dictated by common sense.

'In this complaint there is not unfrequently a great appearance of sickness, and the animal exhibits great restlessness and anxiety, mingled with debility; he trembles and tosses his limbs about, as if enduring great pain. At this time there is also less of involuntarily tremor and convulsive twitchings than at other stages of the disease; and it seems as if the seat of the complaint was in the thoracic or abdominal viscera. Medical men may be naturally enough led to conclude that the animal is labouring under the attack of some other disease than louping-ill; but such is not the case. These are only varieties of the same complaint, which had previously, or will subsequently to these anomalous symptoms, put on its usual and decisive appearances. In fact the disease does occasionally assume so many different forms, although each is more or less connected and allied with the other, that the most skilful veterinary practitioner may for a while be puzzled to say whether it is most akin to tetanus, apoplexy, or palsy.

'The post-mortem appearances are the following:—There is, for the most part, a quantity of thick and turbid fluid, of a greenish or yellowish colour, found collected in the pleural or pericardiac cavity. When the animal dies immediately on being struck, it will often exhibit every appearance of general inflammation. Every part will be turgid with blood, but there has not been sufficient time for gangrene to follow. If the symptoms have not been violent, but the animal lingers for a considerable time, the blood

will seem to have been wasted or consumed, and the flesh white. A considerable quantity of coagulated or extravasted blood is often found on the brain, and also in the cervical portion of the vertebral canal.

'Louping-ill is not only endemic, or confined to particular localities or districts, but often more widely extended, and epidemic. Its contagiousness is doubtful, but it is a periodical disease. The usual time of its appearance in hill-sheep is from the beginning of April to the end of May, during which months it commits great ravages, both among ewes and lambs. From 20 to 25 per cent. are often lost, and in some seasons considerably more. This is, in a great measure, regulated by the spring being late or early. When the grass comes rapidly to a full bite, the apoplectic attacks are most frequent and fatal. A lamb may be eating, and apparently well, and all at once he springs from the ground, utters a violent scream, and falls dead. When skinned the brain and the upper portion of the vertebral canal are found clogged with blood, and the vessels of the head and neck are turgid. At other times, if the animal is not struck dead at once, but lies stunned and unconscious, a sudden bleeding from the eyes or the nose will give relief. An artificial bleeding from the angular vein, and more effectually from the jugular, would have the same effect; but it is a chance whether they are found in this stage, when alone there is the chance of saving them. There is little or no louping-ill during the autumn or winter months. The ewes and lambs in the best condition are the most liable to be attacked by it, although in the months of April and May, after a severe winter, they rarely are so. It is curious that, to the east of the parish, with the exception of only two farms, nothing of this disease occurs.

'If the months of April and May are mild, less of the disease prevails; but if we have cold and sleety easterly winds, it will be more frequent. Dry, easterly, frosty winds, in April and May, are also productive of louping-ill to a considerable extent.'

There appears to be some difference between Mr. Fair's and Mr. Hogg's account, the former stating that it mostly attacks sheep in good condition, and the latter those that are poor. If each account is correct, and the result of personal observation, we may conclude that the disease is peculiar in its kind, and produced by causes distinct from either good or bad condition, though considerably modified by these circumstances.

Mr. Hogg says, that 'twenty years ago its ravages were so considerable, that farmers believed the disease to be infectious. It still exists on some straggling dry farms, where the ground is visibly overstocked; and in dry frosty seasons when the spring is hard and severe. In such places, if March and April are barren,

no green thing is to be attained by the poor creatures for a long space of time. It is easy, then, to conceive the emaciated state into which this must throw them. If at this time they happen to get an overstretch in running, or even a crush in the fold, numbers fall a prey to this disorder. Some will fall down and die in two or three minutes; others will lose the power of one side, and lie sprawling until they die of hunger; others, again, will lie shivering and sick, until death comes to their relief; while a few will go a long time quite lame, until they are likewise quite exhausted.

'When they fall down and threaten instantly to expire, which is certainly an apoplectic shock, I have seen bleeding give immediate relief. In all the other cases, the best method is to take them home and feed them with strengthening food, until they gradually recover. If once by this strong feeding they are attacked by a temporary diarrhœa, they will recover very fast.

'This distemper is peculiar to dry soils, and prevails in dry barren springs when the wind settles in the east. If the sheep are in good condition, they are not nearly so apt to take it; but if they are either low in body, or the wind has a tendency to centre easterly, the greatest care must be taken to use the flocks gently, and it is commendable to avoid cutting off the wool round the udder in ewes that are near the time of yeaning, as the fatigue which they then undergo, and the cold to the most tender parts, are often followed by fatal consequences.'

It is very evident that a disease that owes so much to poverty of blood should be guarded against by the use of oil-cake in addition to natural food.

Rabies or Madness.—This disease sometimes makes its appearance in a flock of sheep, and its uniform fatality, together with the number of its victims, renders it sometimes a source of very serious loss to the flock-master. It is invariably produced by the bite of a rabid animal, usually a dog, the inoculation being communicated by means of the saliva. An indefinite period may elapse between the time of the inoculation and the first exhibition of the symptoms, ranging from two weeks to six, and this is a shorter period than usually supervenes both in the dog and the human being. Sheep, we have observed, never engender this disease, and it is a disputed point whether even in dogs it is ever bred at the present day. Many high authorities incline to the opinion that it is always produced by the bite of another rabid dog; and, indeed, it has been proved by experiment that neither heat, hunger, nor thirst, separate or combined, will produce it. When a dog becomes mad, and breaks away in his career, sheep, from their

habits and disposition, are frequently the subjects of attack, and would probably suffer still more were it not for the circumstance of the wool sometimes wiping the teeth clean ere they enter the flesh. As it is, however, the greater number of those bitten become affected with the disease. The first symptoms which are observed are a diminished appetite, and a disposition to ride each other, to which succeeds a propensity for mischief. The sheep will often butt each other furiously, but will not bite, although they will nibble at a stick if presented to them. There is considerable nervous irritability developed, spasmodic twitchings of the muscles, and quickened respiration. They become drowsy, lose their appetite, and take no notice of surrounding objects. Saliva flows from the mouth, thirst is exhibited, but often without ability to swallow. There is no dread of water at any period of the disease, and in some cases it proves fatal in a couple of days, and in others continues upwards of a week.

Although there are no instances on record of the disease being propagated from one sheep to another, and although the saliva is probably much less infectious in the sheep than in the dog, yet it should be mentioned that in some experiments instituted by Mr. Simonds, with a view to test the fact, it was found that the saliva from a rabid sheep produced the disease in rabbits by means of inoculation: much care should, therefore, be exercised by the attendants, and contact with the saliva carefully avoided.

The *post-mortem* appearances exhibited are of much importance, as, where the symptoms are obscure, they are necessary to establish the proof of the existence of the disease. They are not always alike, but it is very rare that some of the following appearances are not found, and generally they are present together. Much inflammation is found at the back of the tongue, and entrance to the windpipe and the gullet, and the course of the windpipe often shows similar inflammation. Sometimes the first stomach will appear greatly inflamed, and partially filled with indigestible heterogeneous contents; but more frequently the disease will be found most extensively in the fourth stomach, which contains a dark frothy fluid. Sometimes the brain and spinal chord will exhibit the tokens of much inflammation, but in others will appear pretty free from disease.

In the dog these appearancces are present in a more marked degree. The stomach is either full of a dark chocolate-coloured fluid, or distended with a mass of indigestible substances, such as hay, straw, wood, &c., &c. The back of the tongue, and entrance to the windpipe, also exhibit a highly inflammatory appearance, and the brain is often likewise affected.

With regard to a remedy, there is none on which the slightest reliance can be placed, either in the sheep or any other animal; and although in the human subject there is a mode of prevention which rarely fails, yet from the sheep being covered with wool, and the uncertainty as to the parts that may be bitten, very little reliance can be placed on it. It consists either in the total removal of the bitten parts by knife, or the obliteration of its surface by means of lunar caustic, or the application of both knife and caustic. To have a reasonable chance of succeeding by this method in the sheep, it is necessary to clip off closely the whole of the wool, and examine every part of the body with the greatest care; and then using the knife or a stick of lunar caustic, whichever is most convenient, or a hot pointed iron, to apply it thoroughly to every part which has received the contact of the teeth, though only the slightest scratch. If the sheep is anywise fit for the butcher, it will be proper by all means to kill it, and, by carefully removing any part suspected to have been bitten, no danger whatever will be incurred.

As prevention must therefore be always our foremost object with regard to this disease, it is very essential that the sheep-owner and the shepherd should be able to recognise the disease as it exists in the dog. If a dog attacks a number of sheep, and, without destroying or devouring any, inflicts bites on a number of animals, it is at once an object of suspicion. Such animal should not, however, be hastily destroyed, but closely and carefully confined. The symptoms that he will probably exhibit are—a disposition for mischief, which, however, is not invariable, but will be regulated to a certain extent by the previous disposition of the animal; a peculiar glassy expression of the eye, twitching of the muscles, an increasing restlessness, a peculiar and unnatural howl, a copious flow of viscid saliva from the mouth, a want of appetite, but a disposition to gnaw, and tear, and swallow wood, straw, hay, or any foreign substance that may be near. These are the leading symptoms; there are no fits, no running round, no turning or falling over. The animal possesses consciousness throughout, and the presence of fits will be almost sufficient to decide alone that the animal is not rabid. It should be also distinctly observed, that in the dog there is no dread of water, though often an inability to swallow. The dog will often thrust his nose in, and lap the water, though unable to swallow a drop. The author would impress this fact the more forcibly, as a few years since a case came before his attention in which a poor child met with its death in consequence of the ignorance and obstinacy of the attending surgeon, who, because the dog had exhibited no dread

of water, in spite of the positive assurance of the writer that no such dread existed in the dog, refused to adopt those precautions which in other cases, bitten by the same dog, proved entirely successful.

The rabid dog invariably dies within a week, generally about four days from the first exhibition of the symptoms. This fact, therefore, affords an additional reason why the suspected dog should not be destroyed, but tied up securely, so as to test by its death, as well as by the symptoms manifested, the existence of the disease.

A much longer time elapses between the period of the bite and the manifestation of the disease in the dog than in the sheep. The time, however, is uncertain, ranging from six weeks to six months, but usually about two or three months. In the human subject the period is still longer.

It has been very properly recommended by the Duke of Richmond, that the sheep-owner should never keep a savage sheep-dog; and although it is not very common for rabies to be communicated by such dog, if it should become affected with the disease, it is more likely than other dogs to attack sheep, and this danger is greatly increased if the animal is of a savage nature.

When sheep have been attacked by a strange dog, it will be the most prudent plan to examine them carefully; and if any bites are discovered, to apply the lunar caustic as before advised.

Tetanus (Locked Jaw).—This disease, which is more usually understood under the term of *Locked Jaw* (this being a principal and common symptom), consists of a violent irritation of the nervous system, occasioning the spasmodic and violent contraction of the voluntary muscles of the body, particularly those of the neck, jaw, and back. It usually commences with a peculiar motion of the head, and sometimes of the limbs, the jaw becomes fixed, and there is a grinding of the teeth. These appearances, which are involuntary, increase; and the head is bent round, the neck twisted, and one of the limbs fixed. The muscles feel very hard, being in a violent state of action; and sometimes they become less rigid, and convulsions take place. These symptoms are often fatal in the course of twelve hours; but if the sheep survives more than two days, it is likely to recover.

This disease is more common with lambs than with sheep, and is not unfrequently the effect of castration, particularly when the operation is performed with unusual violence, and by means of twisting. Exposure to wet and cold is also a frequent cause, and death arises from this neglect more so than farmers are aware of.

The *treatment* should consist in removing the animal to a comfortable but quiet place, where no disturbance can possibly arise. The body should be kept comfortably warm; and if the subject is a lamb, a warm bath may be used. An active dose of aperient medicine should be given, followed by a dose of laudanum, two or four drams, with the same quantity of ginger in thick gruel, twice a day. The animal should be disturbed as little as possible, for it has been found in this disease that quietude is one of the most important agents in establishing a cure.

Epilepsy.—This disease is somewhat similar to tetanus, being an inordinate action of the voluntary nervous system; but it differs from that disease in being sudden, irregular, and of shorter duration. The sheep when attacked becomes unconscious, will run round, stagger, and fall; and after a while the fit will cease, and the animal will in a measure recover. It appears to be more prevalent on the Continent than in this country. Gasparin states that it is very prevalent in Germany, and is there attributed by the shepherds to feeding on dock and garlic in the winter, and on the young sprouts of the pine in the summer. Tessier speaks of it as being so frequent and fatal in the district of Beauce, in France, though of late introduction there, as to induce many farmers to give up sheep husbandry altogether. He attributes it to some peculiarity in the pasturage. Mr. Youatt states, that having occasion to travel over the downs of Wiltshire some years since, about two hours after daybreak, he saw at least a dozen sheep and lambs with the convulsions of epilepsy strong upon them. The coachman told him that upon every fine cold morning he saw nearly or quite as many. He had also an illustration of the favourite method of cure among some of the shepherds: it was, to destroy one morbid derangement of the nervous system by setting up another. The dog was turned upon these poor animals, who were speedily frightened, not out of their senses, but into them again. He saw this succeed in various instances, but he thought it was a dangerous and a brutal mode of cure. This disease is most frequent with young sheep in good condition, in the spring of the year and the early part of the autumn; and it is supposed to be occasioned by feeding whilst the hoar-frost is thick on the ground. The extremely cold food thus swallowed chills the rumen, and determines blood to other parts, and particularly to the head. It can only be avoided by taking care not to expose the sheep to the danger, by giving them a little dry hay on such mornings, and not permitting them to feed on the grass till the frost has disappeared.

Palsy.—Whilst the disease just described is an inordinate

action of the nervous system, this consists in a suspension of its powers, either wholly or in part. Sometimes the animal is totally helpless, every limb being affected; at other times the palsy is principally confined to the loins.

The cause of this disease is generally cold combined with moisture; the animal becomes chilled, and is found, perhaps after a snowy night, in the helpless state before mentioned. Though more frequently affecting lambs, it may also attack sheep of all ages, and particularly the ewe that has aborted or produced her lamb with difficulty and after a tedious labour in cold weather. It often attacks the newly-dropped lamb, and sometimes proves fatal during the night. When less severe, the lamb is found stationary, and with its hind limbs powerless; and when this is the case it rarely becomes otherwise than stunted in its growth, though after a time it may get rid of the paralysis. This disease is often confounded, and not unfrequently connected, with rheumatism; but the former has its origin in the nerves, whilst the latter, though the more painful, is an affection of the muscles. This disease is sometimes produced by an excess of nutriment or other variety in the food. Mr. H. Cleeve, in vol. i. of the 'Journal of the Royal Agricultural Society of England,' relates the following facts:—'I had been giving two cart-loads of mangel-wurzel daily to about 150 couples. Finding the pasture get short, I one day ordered an extra load, and the following day I found that thirteen of the ewes had nearly lost the use of their limbs. On another occasion, having some hoggets that would not eat the roots, I enclosed them in a pen in order to starve them to it, but as soon as they began to feed heartily they also were similarly affected. If I rightly attribute the complaint to this cause—and, indeed, I have no doubt on the subject—the treatment is to withhold the mangel-wurzel for a short time, and only to return to the use of it gradually and in small quantities.'

The *treatment* of the disease consists in the application of warmth externally, but moderate at first, and gradually increased. A stimulant should be given internally in warm gruel or ale. A dram each of powdered ginger and gentian, with two drams of spirit of nitrous ether, is a dose for a sheep, and may be given once or twice a day; and from one-quarter to one-half the above will be sufficient for a lamb. If symptoms of purging should appear, the treatment recommended under the head of Diarrhœa may be employed.

If the palsy continue obstinate, a minute dose of strychnia may be tried, which is one of the most powerful of stimulants to the

nervous system; a quarter of a grain diffused in gruel will be sufficient for a sheep at first, but it may be afterwards slightly increased. It has been administered successfully to other animals in this disease, but should be employed with great caution, being remarkably potent.

Mr. Cleeve, in the cases above mentioned, bled and gave each an ounce and a half of Epsom salts, under which treatment they all recovered, with one exception.

Rheumatism.—We notice this disease in this place, though of a different class from the foregoing, because it very much resembles, and is in fact closely connected with, that last described. It is, however, an affection of the blood, and attacks the muscles, the joints, and the fibrous parts of the system, and consists in a peculiar inflammation of those parts, very frequently causing considerable pain when they are called into action. It is usually caused by exposure to cold, and sometimes shifts from one part to another, occasionally degenerating into a slow or chronic form, and attacking the sinews, ligaments, and joints, as well as the muscles. It is attended by considerable fever and an accumulation of acid matters in the blood. The neck and the loins are the parts most frequently attacked, either separately or combined. The former affection causes the head to be carried in a bent position, and the latter produces considerable stiffness and weakness of the loins.

The *treatment* should consist in removing the animal to a comfortable shed, giving an active purgative, such as two ounces of Epsom salts dissolved in warm water with a dram of ginger and half an ounce of spirit of nitrous ether. A stimulant, such as hartshorn and oil, or opodeldoc, should be well rubbed over the affected part; and if the disease assumes a chronic form, a seton should be inserted near the part.

DISEASES OF THE DIGESTIVE ORGANS.

The most numerous and most frequent diseases to which sheep are liable are those affecting the organs of digestion, and more losses occur from these than perhaps from all others besides. This might not always have been the case, and perhaps is not so at the present time in all countries. The active Scandinavian sheep of the Zetland Islands, or the hardy breed of the Welsh mountains, living on a scanty pasture, are rarely, if ever, exposed to the mechanical and other diseases of the digestive organs to which other sheep located in richer pastures are so frequently liable. But when we consider the nature and effects of those improvements which have

been introduced in the breed of sheep—the object sought to be accomplished being to produce an animal that will convert vegetable food into flesh and fat with the greatest speed and at the earliest period; that to do this it must be constantly feeding, taking a large quantity of food, and at the same time converting as much as possible into mutton—we cannot be surprised that the organs thus severely tasked should be first and most frequently morbidly affected. Delicacy of constitution is, no doubt, produced by the present system of breeding, and the reason why disease does not more frequently occur is owing to the much shorter life which the modern system entails on the animal; the knife of the butcher supervenes ere the softness of the constitution has induced disease, and the animal is converted into mutton long before the period which nature has assigned for its term of life has arrived.

Obstruction in the Gullet is much less frequent in the sheep than in the ox, but it does sometimes occur, and gives rise to the same symptoms as are present in the latter animal, which are difficulty of breathing, threatened suffocation, blasting, or hoven, and too frequently death. The food most likely to produce this is turnips—too large a quantity being swallowed, or attempted to be swallowed, at the same time, or a smaller portion not properly masticated.

When these symptoms are observed, the sheep should have its head elevated and held firmly between one man's legs whilst another passes the end of a flexible probang carefully over the root of the tongue into the pharynx and thence down the œsophagus, forcing the obstructing morsel with it. Much care must be exercised in this operation; the probang should be oiled and forced onwards with gentle firmness, otherwise there will be much danger of lacerating the coats of the œsophagus. *Probangs* suitable for sheep are manufactured, being elastic and hollow, and admitting a whalebone stilette through it. In the absence of this useful article, a cane or any flexible rod may be used; one end, having a bulb formed of tow and being well oiled, may be employed. If these means should fail, it may be necessary to extract the obstructing body by cutting down carefully on the substance through the skin and the œsophagus, carefully closing the wound both of the latter and the former by separate stitches. Much care should be taken in throwing down and securing the sheep for this operation, as there is danger of rupturing important parts. If suffocation is threatened, it is often prudent to relieve the hoove by means of the trochar before the operation is attempted. It often happens that the membrane lining the œsophagus is lacerated in the attempts to force onwards the obstructing body,

and the animal refuses to feed or to ruminate, and dies in the course of some days. This circumstance induces the farmer frequently to kill the animal after being relieved, and if it be fat this may be a good plan, and particularly if the above symptoms are present. But the sheep may be poor, or perhaps a ram of much value. In either case, but particularly in the latter, treatment should be adopted. Two or four ounces of linseed oil should be given as a laxative, and all solid food for a time prohibited, linseed gruel being substituted for the space of two days, and afterwards followed with good oatmeal gruel carefully strained; water may also be allowed.

If any external swelling is perceptible, it should be fomented and poulticed; but this symptom greatly increases the danger, as it denotes an extension of the laceration through the other coats, and if it is evident that the passage of the œsophagus is stopped, the danger will be still more imminent; but if the animal is very valuable, the swelling should be cut down upon and the œsophagus opened, and afterwards treated as another wound.

Hoove, Hoven, Blasting, &c.—Sheep as well as oxen are liable to this disease, and in them it is generally produced by being turned into, or more frequently escaping into, young clover. The fatal effects of this, when not early discovered, have been very considerable, numbers having died before assistance could be rendered. The immediate cause of the distressing symptoms is the formation of gas in the rumen, or first stomach, which distends it to an enormous size. The food being of a very succulent nature, the heat and moisture of the stomach cause it to undergo fermentation and decomposition. The gases thus formed have been found to contain in all cases carbonic acid, mixed occasionally with inflammable gas, and at other times with sulphuretted hydrogen, and sometimes with atmospheric air. The frequently fatal result is caused by the enormously distended rumen pressing on the diaphragm, and thus preventing the chest expanding so as to admit air, thereby producing suffocation. The reason why cattle and sheep are so much more subject to this disease than the horse is the very limited mastication, and therefore the imperfect mixture with the saliva, which the food undergoes. If, then, it is of a very succulent nature, and is taken very rapidly, fermentation commences, and the gases are given off. It is more likely to occur when the functions of the stomachs are anywise impaired, and it may also be produced by the obstruction of some foreign body in the œsophagus. It is a frequent attendant of other diseases, particularly those of the digestive organs, and it then denotes an

imperfect performance of the functions of the rumen, probably a diminution of its alkaline secretion or an alteration in its quality.

It is customary when sheep are first turned upon clover, or trefoil, or other very succulent food, to keep driving them about for a considerable time, the effect of which is to prevent their eating so much or so rapidly as they otherwise would, and also to favour the escape of any gas that is formed, by means of motion. There is more danger of its occurring when the dew or hoarfrost is on the ground, and it is liable to happen if the sheep should accidentally partake of any food in a state of fermentation.

The remedy must be prompt in order to be successful, and it may either be mechanical or chemical. The hollow flexible probang is at once the safest and easiest mode of relief. The probang should be introduced in the manner before advised, and on its entering the rumen the stilette should be withdrawn and the gases will be liberated.

Much care and some skill are required in this operation, because if the probang is thrust forward with violence there will be danger of rupturing the sides of the œsophagus. The mouth should be kept open by means of a gag, formed by a round stick having a hole through its middle for the passage of the trochar.

Sheep will sometimes die when hoven in the course of ten minutes, affording even no time for the employment of the probang. In such very emergent cases, the course to pursue is at once to plunge the trochar with its canula into the left flank, then withdrawing the former, so as to allow the gas to escape through the latter; and if it does not at once freely and rapidly escape, the sides of the belly should be moderately pressed so as to force it out.

It is often necessary to retain the trochar in the wound a considerable time, so as to allow the exit of all the gas that may have formed or be still forming. If the trochar is not at hand, a penknife may be used instead, though the former is much preferable, inasmuch as the canula can be retained until all the gas appears to have escaped, whereas when the knife is employed the openings in the flank and the rumen may cease to remain opposite each other, and much of the gas, and with it some of the food, may escape into the cavity of the abdomen, and there produce irritation and inflammation. This, indeed, accounts for the many cases of sheep not doing well after the operation.

The modes of relief which offer themselves in the way of medicine, and which indeed may be first tried, if the case is not too emergent, are those of a nature calculated to condense the

gases or decompose them. Those most likely to conduce to this purpose will depend on the nature of the gases, and this will be regulated by the stage of fermentation that is going on. If the early stage, it will be the vinous fermentation; and if later, the putrefactive. In the former carbonic acid will chiefly predominate, and in the latter hydrogen. For the former the preparations of ammonia will be most available, and for the latter those of chlorine. If relief can be given in the early stage, two to four drams of hartshorn in half a pint of warm water will probably effect the purpose; but if the putrefactive process is going on, a dram or two of chloride of lime dissolved in water will best accomplish the purpose. The chlorine will leave the lime and combine with the hydrogen, for which it has a much stronger affinity, and the muriatic acid thus formed will be prevented from doing injury by means of the disengaged lime by which it will be neutralised.

A mode of relief combining the mechanical with the chemical is deserving of consideration, and, indeed, should be employed where the probang or the canula is not at hand, or where, from the number of cases, they cannot be in all available; and that is, forming a number of boluses of flour, lard, and salt, and combining with them, if possible, chloride of lime and carbonate of ammonia, half a dram of each for a sheep, and forcing down three or four boluses thus formed over the root of the tongue into the gullet with the fore finger, the mouth being held open with the left hand or by an assistant.

The advantages of this plan are apparent; the balls are sure to enter the rumen, whilst with fluids it is uncertain, and thus by breaking through the floor of the œsophagean canal, which in hoove is closed, exit will be given to a good portion of the gas, whilst the chemical agents will condense the rest. The medicine therefore must be modified or combined according to the time the sheep has been suffering.

Sulphuric ether will also be found valuable, in doses of two drams, having the property of condensing the gases in a high degree.

It will be prudent to administer some of the above-mentioned medicines with an active purge, even in those cases where relief has been obtained, either by the probang or the puncture, as there is much danger of more gas being formed. The most certain way of doing this is by means of the probang and the stomach-pump, as then it is sure to enter the rumen, whereas if given as a draught it is uncertain what proportion may enter the rumen. In the latter case, however, a larger dose should be administered

Care should also be afterwards exercised with regard to the diet, and the sheep for some little time should be turned into poor pasturage. A more simple plan, perhaps, will be to give the medicine in a solid form combined with vegetable tonics.

Hoove may thus occur either in an acute or sub-acute state. In the former no time must be lost, but the probang or the trochar should be at once adopted, preference being given to the former. In desperate cases the knife may be used; but from the very great after-danger attending this plan, it is worthy of consideration whether, if the animal is tolerable meat, it will not be most prudent to kill it.

In sub-acute cases the boluses may be employed; and if they do not succeed, the probang should then be used.

When hoove occurs from choking, and suffocation is threatened, it will be necessary to employ the trochar to relieve the distension, before the probang can be employed to force down the obstructing body.

In all cases it will be essential to employ after-treatment, as sub-acute hoove is likely to succeed the acute, as well as indigestion; in both, the following will be a draught proper to be given:—

Sulphate of magnesia	2 ounces.
Ginger	1 dram.
Gentian	2 drams.
Chloride of Lime	½ dram.

To be dissolved in a pint of warm water or gruel.

The three last ingredients may, if necessary, be repeated in the form of boluses.

In order to prevent this disease, it will be a prudent method to give the sheep a little old hay in the morning previous to their being turned on turnips, clover, or other succulent food. Mr. Humfrey observes, in the 'Journal of the Royal Agricultural Society of England,' vol. i.: 'It is an excellent plan to sow common salt over the fold which contains their food early in the morning while the dew is on it. In the year 1836 I experienced its good effects while feeding off a piece of rape, having lost several lambs by their being blown. I bought a sack of salt, and had it sown over the fold every morning before the dew was off; and the consequence was that I only lost one sheep afterwards, and this occurred by accident, the shepherd, through neglect, allowing it to run into the rape which had not been salted. There are two advantages to be derived from this simple remedy: it not only directly benefits the general health of the sheep, but all that falls on the ground acts as manure, so that nothing is wasted.'

Mechanical Distention of the Rumen.—Distention of the stomach with food is much rarer in the sheep than in the ox, and when it occurs it is to be attributed to the sudden and rapid consumption of turnips and other roots. It may be distinguished from hoove by the lesser violence of the symptoms; but greater depression and heaviness are present, and the abdomen, though less distended, feels hard and firm, and not elastic, as in hoove. This is a very dangerous complaint when it does occur, and requires immediate assistance. The animal may be first bled so as to relax the muscular contractions of the rumen, and then the probang and the pump should be had recourse to, so as to force liquids into the rumen to soften and dilute its contents, and produce their discharge into the œsophagean canal. With this liquid should be combined stimulants, such as hartshorn, or carbonate of ammonia, to excite the inner coat of the rumen, together with some alkali to assist its natural function, such as a few drams of carbonate of soda; with this a purgative, such us from two to four ounces of Epsom salts, may be properly combined.

If these means should fail and the case become desperate, recourse must then be had to an operation which, though formidable, has yet been performed with success. An opening must be made into the rumen at the left flank, midway between the hip and the last rib, and a little below the lumbar processes. The opening must be sufficiently large to enable the contents of the rumen to be taken away; and in order to prevent their escaping into the abdomen, the sides of the wound in the rumen should be confined to that of the flank by means of stitches during the operation, or the end of a clean towel may be passed through the wound into the rumen for the same purpose, or a leather tube sufficiently large for the contents of the rumen to be brought through it.

The food being thus removed, the wound should be united by stitches, taking care that the orifice in the rumen be also thus united and the ends of the stitches left through the external opening, which should then be united by separate stitches. The food must be moderate and easy of digestion for some time, gruel being frequently administered. The bowels should be relaxed with saline purgatives, and if fever is present the animal should be bled. In the course of seven or eight days the stitches, if they have broken, may be taken away. It generally follows that the rumen remains united to the abdomen after the operation.

Although such treatment is demanded in the case of a valuable ram or ewe, yet, with ordinary sheep, if in fair condition for the butcher, the knife will be the safest remedy.

New wheat has been known to produce very fatal effects on

sheep when largely partaken, as the following cases, related by Mr. John Hawes, in the 'Veterinarian' for 1840, will show:—

'In the month of September, in the last year, a flock of sheep, more than two hundred in number, strayed into a field where there was a quantity of wheat which had not been carried in consequence of the unfavourable state of the weather. They fed rather bountifully on it before they were discovered by the shepherd, when they were immediately removed to the pasture on which they had previously been grazing, and no further notice was taken of them until the following day, when four of them were found dead and several others were evidently ill. To all that evinced any symptoms of disease Epsom salts and castor oil were immediately given; but, on the following morning, finding that twenty-eight had already died and nearly as many more were almost dead, the owner sent for me, as is too frequently the case, when it was too late to be of much service. The first thing that I did was to examine some of those that had died, and I found the rumen in every instance filled with wheat, barley, and straw; the abomasum highly inflamed, as well as the bowels; the spleen had the appearance of a mass of coagulated blood, its structure being entirely destroyed; the lungs, in most of the cases, presented a healthy appearance, as did also the liver. Fifty-eight died in the course of five days after eating the wheat; the others were bled, and half a pint of linseed oil was given to each, and they recovered, but many of them have since thrown their lambs.

Yew Poisoning.—In general, the acute sense of smell which sheep possess enables them to avoid deleterious or poisonous plants; but, occasionally, when these plants become dry and deprived of odour, sheep will partake of them with fatal avidity. The dried branches of the yew-tree have thus destroyed hundreds of sheep, and farmers cannot be too careful in not allowing any to be placed within reach of the sheep, and more particularly in not using these dead branches for making fences. From the fact of sheep grazing with impunity on pastures where yew-trees are met with, it is thought that green yew is not poisonous; but though less so than dead yew, yet impunity cannot be relied on, as we have known various instances to the contrary. We have also known sheep die from getting access to pleasure-grounds, and partaking largely of rhododendrons.

The only plan of treatment that can be adopted is to administer large quantities of liquid by means of the stomach-pump, and then removing as much as possible of these contents by the same apparatus. Purgatives may also be given.

Soot, when taken internally—as it has been when used as a

top-dressing on wheat in the spring, and sheep have been turned on soon afterwards—acts as a poison, producing palsy of the limbs and death. The following instance of the kind is communicated to the 'Veterinarian,' vol. xvi., by Mr. Coates, of Gainsborough :—'Some little time ago I was sent for to make a *post-mortem* examination of some sheep. They were hogs in fair condition, and I was informed that they had been taken off turnips, and turned on a field of luxuriant spring wheat. Ten were down, three dead, and seven paralyzed. The respiration was hurried, the ears and extremities cold, the pulse almost imperceptible, the bowels constipated, the fæces hard and dark coloured, occasional struggling of the limbs, but no very evident pain.

'**Sectio Cadaveris.**—The intestines were free from disease, and rather flaccid; the aliment dark coloured, and covered with mucus. On examining the stomachs, the rumen was found to be half full of dry, impacted, dark-green food, studded over with small black specks, which on further examiniation proved to be soot. The reticulum contained but little food: its surface and papillæ were covered with black specks, and what food it contained was very dry. The abomasum and its ingesta were much darker than is natural. Its villous coat had a slight inflammatory blush, and the mucous secretion was quite black. The other viscera were apparently healthy. I did not examine the brain or spine.

'On inquiry, I found that these sheep had been turned on a field of spring wheat, which only a short time before had been manured with soot; and no rain having fallen, or dew sufficient to enable the land or the vegetation to absorb this carbon, it had been taken up and swallowed by the sheep along with their food. The remainder of those that were paralyzed were destroyed; but all the others, to the number of three or four score, had cathartic medicine given to them, until their bowels were well acted upon. They were then fed on linseed-cake, and ultimately did well.'

Concretions in the Stomachs.—Sheep have sometimes died from the effects of sand and earths taken into the stomachs, producing there, and particularly in the abomasum, considerable irritation and inflammation. That these foreign bodies should produce this injury cannot be a matter of surprise, though it is much less clear what should induce the sheep to take them. There is, however, no doubt that a considerable portion of earth is taken with the natural food, whether grass or roots; and in tearing asunder the blades of the former, some must be torn up by the roots. The effect of this is, doubtless, beneficial; the alkaline earths neutralizes much of the acid developed in the rumen, and

so prevents the animal from being hoven. In the following cases Mr. Youatt suggests that the presence of acids in the stomach must have induced the sheep to swallow the large quantities of sandy earth that were afterwards found in their stomachs. The instances referred to are related by Mr. Gutteridge, in the twelfth volume of the 'Veterinarian.' He says:—'The flock was turned into a field of turnips, but had not been there more than a few days before the shepherd fancied that some sheep were not doing well. They were dull, and lagging behind the others, and altogether indisposed to move: the appetite was gone, and there was heaving of the flanks. He drew twenty-five of the worst, and put them by themselves; and on the following day three were dead. He gave an active purge to the rest, but in the course of four days six more of them had died.

'I was called in, and, of course, availed myself of the opportunity of examining some of the dead sheep. I found the rumen and abomasum, and nearly the whole of the intestinal canal, loaded with sand, and portions of undigested food in various parts of the intestinal canal. I ordered the remainder of the flock to be immediately brought into the fold-yard. Although several of them were purging very much, I gave to every one of them a brisk dose of Epsom salts with ginger, and I kept them in the yard all night. The next morning I found that the salts had taken effect. On the third day a second dose was given, and they were turned into another field. Only one died afterwards. In him I found very little sand, but great inflammation of the intestinal canal, and this was the cause of death.'

Mr. Gutteridge afterwards adds:—'Since my first letter was written, I have had sixty yearlings labouring under a similar disease. I gave to each an active purge of salts, with gentian and camomile, and afterwards a dose of stomachic medicine daily for ten days. Their food, while under treatment, consisted only of dry meat, as cut hay, and a few oats. I saw the shepherd, and he informed me that they were all going on well.'

Bezoars.—In the months of September and October, and seldom at any other period of the year, it is very common to find, sometimes in sheep, but generally in lambs, a number of small balls, often of the shape of an almond, or resembling that of the stomach itself. They are usually of a brown colour, but sometimes inclining to a yellow. On cutting them with a knife they appear to be composed of layers consisting of wool intermixed with earthy substance and mucus. They can be dissolved by means of boiling water, and in all probability by the gastric juice of the stomach, as, though they are common in the autumn, they

are rarely found a few months later. These *bezoars*, as they have been termed, are found as frequently in fat as lean animals; and this being the case, we are not warranted in supposing that they are injurious to the health of the sheep. They are probably formed by the animal licking itself, or its dam, or other sheep, and thus gradually swallowing fibres of the wool, which entwines round some hard portion of the food, and is consolidated by the mucus it meets with.

Diarrhœa, Dysentery, Flux, Scouring.—Under these various terms are comprehended two diseases to which sheep are not unfrequently subject, viz. diarrhœa and dysentery. The former appears to be simply a relaxed state of the mucous membrane of the bowels, producing liquid fæces, whilst the latter is an inflammation of this membrane, producing not only an increased secretion, but a morbid alteration in its character. Dysentery therefore is a more dangerous disease than diarrhœa, and whilst the latter is mostly confined to the small, the former attacks principally the large intestines.

The *symptoms* of dysentery, which in some places is called braxy, are those of much constitutional disturbance and fever. The sheep is dull and uneasy, frequently lying down and soon rising again. The breathing soon becomes disturbed, the pulse wiry and quick, the mouth and nostrils hot and dry, and the membrane lining the eyelids red, and it has been stated that the wool feels drier and is more easily removed. The fæces are scanty in quantity and hard, though frequently discharged, and attended with blood and mucus, having an offensive smell. This fetor increases and the fæces are discharged with pain, and in some cases the animal dies in a few days, and in others the disease takes a chronic form and lingers on for weeks.

Diarrhœa may be known from the absence of these severe symptoms; and it is important to observe the distinction, as the same treatment will not be proper for both diseases.

The causes of dysentery are principally sudden changes of pasturage or situation. The most frequent of these is the removal from succulent to dry pastures in a high situation. In these cases diarrhœa was the first disease, which, however, soon went on to dysentery; and if, when the former appeared, the sheep were early removed to the low pastures, they soon recovered. Lambs are most frequently affected, but older sheep are also attacked. It is also produced by exposure to cold and wet after travelling, and by anything that can directly or indirectly derange the digestive organs. In sheep that have died of dysentery, the mucous coat of the intestines, particularly the large, has been found in a state

of high inflammation, and even ulceration, with hard offensive fæces, the maniplus also containing hard and indigestible food.

As it is a matter of much importance to distinguish this disease from diarrhœa, it will be well to direct attention to the following distinctive characteristics of the two diseases from the pen of Sir G. Mackenzie, as they are worthy of attention :—

'1st. Diarrhœa attacks chiefly hogs and weak two-year old sheep, whereas dysentery is frequent among such as are older.

'2nd. Diarrhœa almost always occurs in the spring and ceases about June, when dysentery only commences.

'3rd. In diarrhœa there is no fever or pain before the stools, as in dysentery.

'4th. In diarrhœa the fæces are loose, but in other respects natural, without any blood or slime; whereas in dysentery the fæces consist of hard lumps passed occasionally, the rest being blood and slime.

'5th. There is not that degree of bad smell in the excrement, in diarrhœa, which takes place in dysentery.

'6th. In dysentery the appetite is totally gone; in diarrhœa it is rather sharper than usual.

'7th. Diarrhœa is not contagious; dysentery is highly so.

'8th. In dysentery, the animal wastes rapidly, but in diarrhœa only a temporary stop is put to its thriving; after which it makes rapid advances to strength and vigour.

'9th. Dysentery is commonly fatal; diarrhœa rarely, unless the animal has been previously much debilitated.'

In some cases related by Mr. Stevenson, a surgeon who devoted much attention to the disease, the symptoms of dysentery were frequent stools, slimy and mixed with blood, having little feculent matter in them; the wool was clapped; the mouth and skin dry, the eyes languid and red, constant rumbling in the belly, and the animal could with difficulty stand. On lying the hand on the belly, it could be felt in some parts as it were drawn together, and lumps in parts of it.

The treatment of these diseases must of course depend on the stage in which they exist, but it is desirable to attend to it as early as possible, and when diarrhœa only is present. A natural cure, which is sometimes practised in Cumberland, is to turn them into pasture where common tormentil or septfoil abounds, and this is frequently sufficient to effect a cure, the properties of this plant being highly astringent.

If the cases are not severe, and entirely confined to diarrhœa astringents alone may be given; but if any mucus is perceived, i will be proper to administer a laxative in the first instance. Th

following treatment is related by Mr. Sayer, in a useful essay on the disease, read to the Veterinarian Medical Association:—

Linseed oil	2 ounces,
Powdered opium	2 grains,

were given to each sheep in an infusion of linseed, the gruel being repeated several times, and on the following day the opium was again administered, with half a dram of powdered ginger and the same quantity of gentian, which was given several times, and sometimes combined with linseed oil.

This treatment proved successful, and is indeed as good as can be advised, the food being also attended to, and proper care bestowed.

The treatment adopted by Mr. Stevenson with success was the following:—In a case where the habit of body was good, he bled in one of the veins in the fore-leg, and about two ounces of blood of a dark colour were taken from it. A dose of an ounce of salts was then administered, which in eight hours produced several passages, and the pain in the bowels seemed in some measure to be abated. Next day five grains of ipecacuanha were given every two hours for five hours, which still kept up the purging; and considerable sickness was apparent. In two hours after the operation of the ipecacuanha it began to eat a little, and the skin was somewhat moist. The frequent stools now abated, and there was no more purging, nor was any more blood passed. In six days it was so far recovered as to be able to join the flock.

In cases of simple diarrhœa, the following astringent medicine will be found very useful:—

Powdered chalk	1 ounce.
„ catechu	4 drams.
„ ginger	2 „
„ opium	½ dram.

To be mixed carefully with half a pint of peppermint-water, and two or three table-spoonfuls given morning and night to a sheep, and half this quantity to a lamb.

Since our text was first written, cotton-seed cake, a new article of ood for sheep and cattle, has been introduced, and is not only highly nutritious as an article of food, but it has a specific effect in preventing or removing diarrhœa. About half a pound a day is sufficient for a sheep.

Lambs are, probably, more subject to diarrhœa than sheep. This is owing, in a great measure, to the change of diet which takes place at weaning, and to the functions of the stomach being called into greater action. It often occurs when they are

turned with the ewes into rich pastures, the new stimulus which the food possesses exciting too much the digestive organs. If the looseness is moderate, it may pass off without injury; but if it continue, recourse should be had to treatment. The danger will depend on the appearance of the little animal, which, if lively and cheerful, will probably do well; but if moping and dull, a fatal result may be anticipated. It is often called the *green skit* from the colour of the fæces, and as a distinction from another disease called the *white skit*, which is of a very different nature. It will sometimes be prudent to administer a little opening medicine, such as two drams of Epsom salts, to clear out the intestines previous to the cordial medicine above mentioned, which will generally succeed.

The *white skit*, so called from the pale colour of the fæces, is a more dangerous disease; and its danger does not arise from looseness, but rather from constipation, being in fact owing to coagulation of the milk in the fourth stomach, where it often increases to the amount of several pounds, whilst the whey passes off by the bowels, and gives this deceptive appearance to the dung. It is a natural function of the fourth stomach to cause this separation in the elements of milk; and indeed the dead stomach will produce the same, as is shown by the employment of the rennet, or calves' stomach, in the manufacture of cheese. This property is owing to the gastric juice, secreted by the internal membrane of this stomach, which abounds indeed with muriatic acid. The disease is, therefore, an excess of the natural functions of the stomach. The milk is either too rich or taken too largely, or coagulated too quickly from the increased powers of the gastric juice, which it acquires when the lamb begins to take other food.

The *symptoms* are, in addition to the colour of the fæces, dullness, heaving of the flanks, hardness and distension of the abdomen, and sometimes costiveness.

The *treatment* must consist in the administration of alkalis, their property being to dissolve the hardened mass. Half an ounce of magnesia dissolved in water, or both these medicines combined in less quantities, should be given and repeated, and followed with Epsom salts; after which a little of the cordial medicine may be given. It will be desirable to give the above medicines in a large quantity of water, in order to ensure a sufficient part entering the abomasum; as otherwise, rumination having ceased, a large portion may remain inactive in the rumen.

It is well pointed out by Professor Simonds that diarrhœa is usually a symptom of indigestion. When, from any cause, the

course of nature is interruputed, purging is a common result: therefore in seeking a remedy it is most desirable to remove the cause. Thus scouring is frequently due to the presence of worms in the windpipe, and can only be relieved by their removal or destruction.

We quote him on the subject more at large under the head of 'Bronchitis.'

The White Scour on Turnip Lands is often considered to be due to a too rich diet of corn and cake with turnips causing a disarrangement of the lacteal organs, and inducing an excess of *colostrum* in the milk, which has a purgative effect on the lamb, and also of lactic acid. The curd or *caseine* is thereby separated in an undue degree, and the whey passes off as a white fluid. We are inclined to doubt the fact of its being produced by too rich feeding, and particularly by artificial food, inasmuch as it is rarely met with in the Dorset and Somerset ewes, even when they are supplied with sufficient not only to fat their lambs, but themselves at the same time. No food can be more healthy than good linseed cake, which has the effect of neutralising the consequence of an excess of watery food, and of preventing so much being consumed as would otherwise be the case. We are rather disposed to trace the mischief to an excess of turnips or watery food, the presence of too much acidity, and an insufficiency of alkaline and saline matters. The remedy should be temporary separation from the ewe; oatmeal gruel being substituted for the milk, and some bicarbonate of potash, such as half a dram with ten grains of rhubarb, and some nutmeg or other spice, given twice a day.

Diseases of the Intestines.—Diseases of the intestines are much less frequent than those of the stomachs, and, compared with many other animals, the functions of the bowels are less important. The food has undergone a considerable elaboration before it reaches them, and unless the functions of the stomachs are impaired, the bowels are rarely deranged by the action of the food. Both in constipation and in diarrhœa the stomachs are affected as well as the intestines, and when the latter are inflamed the former generally participate in the inflammation. *Sheep* are rarely subject to

Spasmodic Colic, but lambs may be, perhaps, somewhat oftener. The symptoms are those of severe pain, not constant, but in paroxysms.

The *treatment* should consist of the administration of half an ounce of Epsom salts, dissolved in warm gruel or water, with a dram or two of powdered ginger, according to the size of the animal, and a tea-spoonful of the essence of peppermint. It should

be given slowly and carefully, so as if possible to enter the abomasum.

Though the intestines may sometimes be twisted and strangulated, there are no cases on record of either intus-susception or strangulation, diseases frequent in the horse, and occasionally found in cattle.

Inflammation of the Bowels.—Acute inflammation of the bowels is also of unfrequent occurrence, but it occasionally appears, and sometimes involves disease of all the neighbouring viscera. Mr. Tochenlin, a veterinary surgeon in the grand duchy of Baden, gives an account of a formidable disease of this nature. He says: 'It prevails mostly in July, August, and September, before the heat of the summer has passed over, and when the animals are beginning to moult. The first symptoms are those of influenza; the gait becomes uncertain and staggering, the eyes are half closed, red, and weeping; the appetite fails, and rumination ceases; the bowels are constipated, the flanks are swelled, the breathing is laborious, the emaciation rapid and extreme, and the animal often dies in the course of a few days. Sometimes the sheep perishes suddenly, with scarcely any symptom of previous disease.'

After death, the paunch is found distended with gas and with food—the latter in a state of putrid fermentation, and necessarily producing the former. The small intestines are in a grangrenous state, the liver is partly decomposed, and filled with vitiated bile; but, most of all, the spleen is gorged with blood, softened, enlarged, not unfrequently ruptured, and filled with tubercles and ulcers, with, in short, various appearances of disease, but all of them the consequence of inflammation principally belonging to this gland, and of the most serious character.

This severe and complicated disease is, fortunately, rarely met met with in this country. If it should occur, it should be met with active treatment. Bleeding from the neck in the early stage, mild aperients, setons, and blisters, appear to be called for; but depletion should not be persisted in long, and should be followed with plenty of gruel, vegetable tonics, and good nursing.

Worms.—Sheep are subject to injury from the presence of worms in the intestines; and, as in the human subject, young animals are more susceptible than older ones. The following account, in vol. xv. of the 'Veterinarian,' furnished by Mr. Copeman, of Walpole, Suffolk, is both singular and interesting: —'September 6, 1841.—I was requested to look at a flock of lambs, about fifty of which appeared to suffer from violent diarrhœa. Two of the same flock having already died, I proceeded to examine them.

'The first stomach contained only a small quantity of imperfectly masticated food; the second and third were contracted and empty; the fourth, or true stomach, contained only a small quantity of mucus and sand, but there were several larger patches of inflammation on its villous membrane. The small intestines contained thousands of the folded tape-worm (*Tænia plicata*), and about twenty-five of the large worms (*Ascaris lumbricoides*), with a large quantity—several ounces—of sand. I regret much not having weighed it. The villous membrane was in a stage approaching to *sphacelus* (mortification), probably produced as follows. The vermis causing irritation of the stomach and intestines, induced by sympathy a depraved appetite, so that sand is licked up, and the effect of this foreign body on the intestines is inflammation and its sequelæ. This, however, is but conjecture. The rectum contained chyme and mucus of a grassy green hue. The other contents of the abdomen and pelvis were perfectly healthy, as were those of the thoracic cavity. I next examined the living animals, and found about fifty of them in a sad pickle about and under the tails, from frequently passing mucous fæces. The fæces were of a grass-green colour, and not in the least fetid or bloody. The animals ate but little food, and were usually found lying, evidently suffering much abdominal pain, and all of them reduced to mere skin and bone.

'My first advice was to make a total change in the diet. The following medicine was tried: Castor oil, 1 oz.; powdered opium, 3 grs.; starch, 1 oz.; boiling water sufficient to make a draught. Thin starch, night and morning, was also ordered to be given.

'7th. The lambs are certainly better: continue the medicine.

'11th. The irritation of the stomach and intestines being to a certain extent removed, I ventured to give the following stimulant, for the purpose of destroying, if possible, some of the parasites:—Linseed oil, 2 ozs.; oil of turpentine, 4 drs. One dose only was given to some of them; others required two; and a few had three or four in the course of the following month, and then all were well.'

The sheep, before Mr. Copeman saw them, were pastured on salt-marshes by the sea-shore. Might not the sand have been washed or blown up from the sea-shore, and deposited on the grass, and thus have been taken with the food?

Tape-worms—Since the first edition of this work was published, *Tape-worm* has become a much more frequent visitation and its character and natural history is now better understood than formerly. It is most frequent with lambs, in whose intestines the *entozoa* have been found of enormous length. They are now

known to be developments of hydatids, which have been given to dogs and cats, and have produced tape-worms in their intestines. Turpentine is the best remedy, and may be given with linseed-oil to the extent of four drams to an ounce of spirits of turpentine, combined with two ounces of linseed-oil, and mixed with gruel, and repeated twice or thrice, if required.

Professor Simonds has given the subject of worms in sheep considerable attention, and he thus speaks when addressing the Council of the Royal Agricultural Society on the subject of *Tape-worms*:—

'Their natural history is pretty well made out; they are, in fact, the perfect entozoa arising out of hydatids, those peculiar bladder-like bodies which are met with in different parts of the organism of various animals, and which are nothing more nor less than the scolices of tape-worms.

'It is not many years since that scientific men were astonished by the discovery of Von Siebold, that the *Cyticercus fasciolaris*—the hydatid met with in the liver of rats and mice—was only a "stray tape-worm which had become vesicular, and was, in fact, the *Tœnia crassicolis* of the cat." Shortly after this, even greater surprise was produced when the same distinguished naturalist affirmed that the hydatid of the brain of the sheep, *Cœnurus cerebralis*—the cause of the disease termed "gid"—was only the scolex of the *Tœnia serrata* of the dog; and that the detached segments of this worm, in which its ova were alone perfected, would, if given to sheep, produce hydatids in the brain, and that tape-worms were quickly developed in the intestines of the dog by giving this animal the so-called heads of the *cœnurus*. A number of other experimenters confirmed the conclusions arrived at by Siebold, thus proving that some of the entozoa underwent regular metamorphoses, and that hydatids and tape-worms had a necessary and mutual dependence on each other. It has since been shown that many entozoa pass through more complex changes than the tape-worm; and they often exist out of the bodies of the animals which they ultimately inhabit in such peculiar forms and for so long a time as almost to set at nought the efforts of the helminthologist to unravel their several transformations.

'The dog is infested with something like seven or eight varieties of tape-worm; and, with one exception, I believe the whole history of the tape-worm is known. In common with Dr. Cobbold, I have for some time been engaged in investigating the development of this class of entozoa, and I have by me tape-worms of different ages produced from hydatids which have been given

to dogs, cats, and other carnivorous animals. We gave the hydatids to the dog, and killed him within a certain number of days, and found the product of the hydatids present. And so we followed the development of these creatures from time to time.'*

Worms in the Intestines.—Professor Simonds states that there are two forms of worms which inhabit the intestinal canal, and lay the foundation for diarrhœa. One of them is a worm called, from the peculiarity of its formation, the *Trichocephalus*, or hair-headed worm. Though common in many animals, it exists to a greater extent in sheep than other domesticated animals. These trichocephali are very often a great source of mischief. They burrow their heads into the mucous membrane, and exist more particularly in the cæcum and colon, and but very rarely in the smaller intestines; dwelling there, and producing an irritation of the intestinal canal and diarrhœa, and, looking at the sheep, we cannot at first say whether the worms are or are not the cause of diarrhœa. If, however, a large number of sheep are affected, and a good deal of mucus is discharged with the alvine evacuation; if all ordinary means of arresting the diarrhœa fail; and if the animals, although wasting, nevertheless have a tolerably good appetite, we may conclude that the diarrhœa is due to worms; for, as a general rule, when worms exist in the intestines, there is rather an increase than a diminution of the appetite. Generally speaking, when we effect the expulsion of the trichocephali, they come away in a mass; and no sooner do they quit their hold of the mucous membrane than they run together, thus producing a large lump or mass. In this way they are usually expelled; and it is with difficulty that you can separate one of these long-necked worms without breaking it, in consequence of its neck being twisted in all possible directions with that of others.

They exist as perfect males and females, and in about equal proportions. The young trichocephali may be hatched within the intestinal canal, or the ova may be cast out with the fæculent matter, and lie in the pastures, where thousands perish; but if only two eggs enter the organism and attain perfection as male

* Dr. Cobbold, speaking of the tape-worm, terms it a chain of zoids, or individualised creatures linked together in single file. He gives an engraving of a beef tape-worm, thirteen feet in length, having 1,200 joints of segments, each capable of developing 30,000 eggs. The small cysts often found in pork (constituting measly pork) is rare in cattle in this country, but very common in India, where too it occasionally affects sheep, and is then termed mutton-measles. It is, however, but a link in the chain of the tape-worm, and, like the hydatid, may become either cause or effect. In India the dirty habits of the natives greatly conduce to this disease.

and female, a great deal of injury will be sure to follow. The ova are, indeed, frequently received into the digestive system of sheep, through their food and drink; and there finding warmth and moisture, the young worms quickly escape, and begin to develop within the intestinal canal.

The trichocephali are so productive of mischief from the circumstance that they insert their heads into the mucous membrane, and draw their nutriment, if not directly from the blood, yet from its immediate pabulum. When worms like these exist in large numbers they produce immense irritation, which leads to diarrhœa; and as this form of diarrhœa will not yield to ordinary treatment, a great number of sheep are necessarily lost. These tricocephali appear to be as common as they are mischievous. Everybody knows that vicissitudes in the weather, a luxuriant growth of grass, too large a quantity of green food, turnips, and so on, will produce 'scour;' but if no such causes as these are in operation, we may begin to suspect that any existing diarrhœa is attributable to trichocephali. Again, if upon a post-mortem examination of these wasted animals no filariæ are detected in the bronchial tubes, it may readily be inferred that the worms may be found in the intestines.

The means of getting rid of them are, in principle, the same as those already mentioned. A fair and free use of common salt will be effectual, and can be brought to bear directly upon them, as well as sulphate of iron. Some persons attribute the efficacy of sulphate of iron to the circumstance that these creatures have no iron in their blood or circulating fluids. Whether this be the correct explanation he could not say. Sulphate of iron, however, should not be administered to the animals on the same day as the salt. The salt may be given to the extent of a quarter or half an ounce at a time, but not beyond on its continuous use. Salt and sulphate of iron may be given with the food on alternate days. Half a dram of the latter is a full dose, even for a large sheep. This treatment will be found to be a most efficient means of getting rid of the tricocephali. These are the means we possess of giving relief in cases of this particular entozoic disease.

He would next notice another parasite which does great mischief to lambs, and sheep especially, owing to its producing diarrhœa. There is one form of 'scour' that is absolutely and directly due to the presence of entozoa. These entozoa, however, are totally different from those we have been considering, and, strictly speaking, they are not filariæ. The technical name it bears is *Trichocephalus affinis*, which signifies a hair-headed worm, allied to the one met with in man. The worm, as a rule, inhabits

the larger intestines of the sheep, and is oviparous. The young are hatched directly from the ova, and consequently there are no transformations through which the worm passes. If the fæculent matter of a sheep is watched, these worms will then be seen to come away rolled up in little masses. As soon as they get notice to quit they congregate together, twist themselves up into balls, and in that form are expelled from the system.

The *Sclerostoma*.—Another kind of worm, not so well known as the tricocephalus, but also the cause of diarrhœa in sheep, is the one designated sclerostoma—hard-lipped or hard-mouthed worm. This also exists in the large intestines, attaches itself by its sucking disc or mouth to them, feeds on the juices of the intestines, and lays the foundation for diarrhœa in the same manner as the trichocephali do. Very frequently these two kinds of worms co-exist in immense numbers, and I myself have taken many of both from the same animal.

Pining.—Although a dry state of the fæces is natural to sheep, and they are enabled by nature to subsist on arid and comparatively indigestible food, yet in some localities they suffer much from an excess of dryness in the pasture, and many die in consequence. In the southern districts of England the disease is not much known; but in North Britain, and particularly in the Cheviot Mountains, it is very prevalent; and it is a curious fact that the very land which formerly produced the rot, on being drained now produces this disease, which is there termed *pining*. It would be well if some botanist were to examine thoroughly the various grasses that are found in these disease-producing spots.

Dr. Playfair relates, that on a recent visit into Somersetshire with Dr. Daubeny, they were told by a farmer that he had two fields, one of which invariably purged his cattle, and the other bound them. On examining the pastures, Dr. Daubeny soon discovered that the former abounded in purging flax (*Linum Catharticum*), and the latter with the common tormentil or septfoil (*Potentilla tormentilla*), a very astringent plant.

The disease is thus described by a recent writer:—'In certain parts of Scotland there is a most destructive and ruinous disease among sheep, called *Pining*, a very descriptive word, derived from the verb to pine, or languish; "for no creature," says the Ettrick Shepherd, "can have a more languishing look than a sheep so affected." In the course of nine years Mr. Hogg lost upwards of 900 sheep by its ravages.

'The principal districts of this disease are the green pastures of the Cheviot Mountains, the chains of hills running through the

south-west parts of Roxburghshire, the pastoral districts of Selkirk and Peebles-shire, Galloway, and some other districts in Scotland. Mr. Hogg says that pining is quite a new disease on the border, but that in some of the districts just enumerated it has been known for ages under the name of the *Vinquish.*

'The distemper is a strange one; it may affect a whole flock at once. The first symptoms to a practised eye are lassitude of motion, and a heaviness of the eye. On attempting to bleed, the blood is thick and dark coloured, and cannot be made to spring; when dead, there is found but little blood in the carcass, and even the ventricles of the heart become as dry and pale as its skin. On the genuine pining farms, the disease is more fatal in dry than in wet seasons; and most so at that season when, by the influence of the sun, the plants are less juicy, or early in autumn, when the grasses which have pushed to seed become less succulent. Consequently, June and September are the most deadly months. If ever a farmer perceives a flock on such a farm, having a flushed appearance of more than ordinarily rapid thriving, he is gone. By that day eight days, when he goes out to look at them again, he will find them all lying, hanging their ears, running at the eyes, and looking at him like so many condemned criminals. As the disease proceeds, the hair on the animal's face becomes dry, the wool assumes a bluish cast; and if the pasture is not changed, all those affected will fall in the course of a month. But even this remedy is not always successful; for on one occasion, on the first symptoms of the disease, Mr. Hogg changed the pasture of the hills for two fields of young clover, and changed the stock on these every fortnight. This probably saved a portion of the sheep, but, in spite of all efforts, fourteen score died. Pining proceeds from an enervated and costive habit, producible by want of proper exercise and eating astringent food. The only effective cure, therefore, seems to be a change of pasture to one of more succulent herbage. Mr. Hogg mentions this as a certain remedy, when resorted to in time; and if the sheep are laid on clover, the cure is quicker. The shepherd will notice whether the change of food has the usual effects of medicine on the sheep. When such is the case, the animal is safe. Nevertheless, these sheep will always be liable to take the disease again, either that year or the next, so that a farm cannot be subject to a more ruinous distemper. The farms most liable are those dry farms, abounding in flats and ridges of white and flying bent. These are the bane of the flocks, especially when the surrounding bogs do not yield herbage sufficiently rich and succulent to counteract the astringent effects of the former; for it is found that exactly in proportion as the succulent and laxative

herbage prevails over the dry and benty, the effects of pining are less felt. On steep and rocky lands, where the herbage is sweet and short, the disease does not exist; and on hard heathy lands, which are generally intermixed with little green stripes called gairs, it is scarcely known. But there are few of those strong, deep, grassy farms, which prevail so generally over the southern districts of Scotland, on which there are not some parts which require to be constantly watched, and the sheep driven from thence once or twice a day, otherwise the pining is sure to appear. Thus, in dripping seasons, shepherds, by strict attention in changing the sheep's pasture every day, may in great measure prevent its ravages; but in a dry season, without in-field land sown with succulent grasses or limed, it is impossible to prevent it.

Although the amazing rapidity with which this disease becomes diffused might lead to the conclusion that it is as contagious as fire, yet such does not seem to be the case. It proceeds wholly from the nature of the food, as is proved by the fact that on inlands where it is but partially known and little regarded, a straggling sheep will take it, and cling to its dry spot of astringent herbage till it dies, and yet none of the rest be affected by it.

The lands which are now most subject to this disease were once, in the same manner, liable to the rot. As the draining of the sheep pastures proceeded, the rot gradually became extinct, and was ultimately superseded by the pining. In the one case the land was too wet, and in the other too dry. An intermediate state is required, to attain which, as soon as the land has been fairly drained, a little subterranean agriculturist industriously plies his trade. This subsoil ploughman is the mole. According to Mr. Laidlaw, before draining was begun in his district moles were seldom to be found except in dry loamy soils, the finer parts of which were termed green gairs, from the darker shades they assumed in consequence of their superior fertility. The boggy soils were too wet and adhesive to suit the subterranean habits of the mole; but these being drained, were immediately frequented by the animal, which was supposed to do considerable damage by letting out the water with its cross-roads; spoiling the sides and filling up the drains. The moles were therefore diligently pursued and exterminated. But with what result? The green gairs disappeared, soft succulent plants were found to languish and die; herbage became coarse, harsh, unpalatable. Mr. Laidlaw says:— 'In the place of the mountain-daisy, the sweet-scented vernal grass, the healthy sheep's fescue, the rich native clovers, the aromatic yarrow, the spreading rib-grass, which with their kindred plants delighted the sight, a quite different and inferior set of plants

frequently possessed the soil, such as moss and lichens, tufty hair-grass and the like. This had been produced by want of that constant supply of fresh earth which the mole brings to the surface, and which, whether spread regularly by the farmer, or casually by the sheep and lambs in the active exercise of playful instinct, or even allowed to remain as thrown up, covers annually a considerable portion of the surface of such farms, and must tend to produce greater variety and better herbage.' The farmer will therefore do well to consider whether in destroying the moles he is not depriving himself of a set of most useful labourers. In his search after food the mole turns up, and brings into activity, those portions of the soil beneath, which but for his labours would have remained useless. Mr. Hogg is of opinion that the extirpation of moles is the primary cause of the pining of sheep; and Mr. Laidlaw gives a number of cases in support of the fact, and mentions that of a farm on which during ten years there was little draining and no mole-catching, and the sheep were free from the disease, which however appeared during the ensuing ten years, when the land was drained and the moles partially destroyed, and greatly increased afterwards when the moles were nearly eradicated; but afterwards gradually lessened when the moles were suffered to increase and extend their labours unobserved. But although moles may not be injurious to sheep pastures, they are very objectionable on arable lands.

It cannot be doubted that the effects of this severe disease can be best counteracted by taking care to change the sheep from time to time to more succulent pasture, which should therefore be cultivated assiduously, and employed as it were medicinally; and it is worthy of suggestion whether the culture of plants having laxative qualities, such as the purging flax, would not be highly useful in the way of prevention.

With regard to medicine, the Epsom and Glauber salts offer themselves as the most suitable, and the employment of common salt will also be found of much service.

Redwater.—The disease understood by this term consists of an effusion of reddish-coloured serum or water in the abdomen, outside the bowels, and is the effect of increased action of the membrane called the peritoneum, which forms the outer coat of the bowels, and also lines the abdominal cavity. It is the natural office of this membrane to secrete a watery fluid, in order that the bowels should glide readily on each other; but when diseased action is set up in this membrane, its secretion becomes excessive, and the serous portion of the blood, mingled with some of the red portion, becomes effused in this cavity, where it cannot escape.

The disease is extremely common to lambs, both during the time they are with their dams, and after they have been weaned; and in them, as well as in sheep, it is very fatal, destroying the latter in twenty-four hours, and the former in less time.

The nature of the fluid effused is similar to the serum or watery portion of the blood, and as there is no active pain manifested, we are not justified in considering that it is the effect of inflammation, but one rather of debility of the vessels, and the existence of too much moisture in the system. It usually attacks both sheep and lambs when feeding on turnips, and particularly when there is a hoar-frost, and the sheep are folded on them during the night. From this circumstance it has been attributed to the effect of lying on the cold damp ground, thus chilling the system, and particularly the abdomen. But the sheep is an animal covered with wool, which can readily bear this exposure, and it is more likely to be produced by an excess of this cold watery food taken into the system, though perhaps assisted by cold lair. The use of salt is to be recommended whenever there is reason to fear an excess of water in the food. It may often be sown over the turnips and rape with advantage.

This view of the matter, too, is borne out by the fact, that where ewes in lamb are kept too much or too long on turnips, they often cast their lambs, which are found dead and *water-bellied*, as it is termed; that is, the abdomen is found distended with the same description of watery fluid as we find in redwater. Now in this case the ewe generally escapes disease, therefore it cannot be from external cold, but from the nature of the food; so likewise it is most probable that such is the case with redwater.

The *symptoms* usually observed in sheep are refusal to feed or ruminate, a dull heavy appearance, often attended with giddiness, a staring eye, obstinate costiveness, and sometimes the head is carried on one side. In lambs these symptoms are less decidedly marked, but the little animal lags behind its fellows, is unwilling to move, and is very dull, and dies in a shorter time than the sheep. Acute pain is rarely manifested in either sheep or lamb, but they are generally carried off in a short time. It is not at all uncommon for the shepherd to leave them apparently well overnight, and to find one or more dead in the morning.

The *treatment* of the cases where the symptoms have fully manifested themselves will generally be unsuccessful; but in the earliest stage, and before the disease has actually been developed, much can be done. The sheep should be removed to a drier situation, and pasture or seeds or stubble should be substituted for the turnips, and the following medicine administered:—

Sulphate of magnesia	1 lb.
Gentian, powdered	1 oz.
Ginger, dissolved in warm water . .	1 „

This is sufficient for eight or ten sheep, or double or treble the number of lambs.

Above all, it is desirable, by way of prevention, to remove the healthy sheep to some dry pasture, giving them good sound hay, a little corn, and turnips only in moderation. Such, however, is the fatality of the disease, that it is a question whether it will not be more prudent to kill the sheep or lambs affected; that is, if they are in any condition for the table, or unless from any particular reason, such as remarkable value, it is very desirable to preserve them. Bleeding in these cases will not be prudent unless we are sure that inflammation is present, which we may expect if active pain is manifested.

Mr. W. Greaves advises the employment of tar as a preventative, and adduces the following instance of its successful employment. He says: 'This disease is very prevalent in this part of Derbyshire, and a friend of mine, Mr. Cooper, of Ashford, for many years lost one-fifth of his hoggets from redwater. Three or four years ago he was advised to bring them into a yard, and give each hogget a table-spoonful of common tar every fortnight, and the consequence has been, that although they are kept in every respect in the same way as before, and on the same ground, he has not lost one sheep since the adoption of this treatment.'

We give the above on the responsibility of the adviser, in case any farmer may be desirous of trying it, but we can give no opinion as to its efficacy.

DISEASES OF THE CHEST.

Though diseases of the organs of respiration are less frequent than those of digestion, yet they often occur either in the milder forms of catarrh and influenza, or the more severe visitations of inflammation of the chest, or substance of the lungs; and, indeed, many sheep are annually lost by these diseases.

Catarrh, or **Cold,** is very common at the fall of the year, and particularly if the season is unduly wet, or the flock has been much exposed, or driven about from place to place. It is very common at the autumnal fairs to find great numbers of sheep coughing continually, and having a considerable discharge of mucus from the nostrils. The disease consists of inflammation of the membrane lining the chest, nostrils, and throat and windpipe. From the changes of the weather, and exposure to wet, particularly

after being heated by travelling, and often before the fleece has grown sufficiently after shearing to afford proper protection, the membrane before spoken of becomes inflamed, a considerable increase of its natural discharge takes place, and a cough is produced, either as a consequence of the inflammation of the membrane at its most irritable part, or from the irritation excited by the presence of mucus. The disease will sometimes continue in this state for several weeks, and nature will effect a cure; but it is well if it does not lead to anything worse, for sometimes the inflammation will extend itself to the lungs, and prove fatal. The effect of a cold is, at least, to retard the improvement of the animal, and every severe case should be met with attention, and, if possible, more shelter and good nursing. This alone, in mild cases, with the assistance of a little gruel, will effect a cure; but if the fæces are unhealthy, and if the symptoms require it, half an ounce of Epsom salts, a dram each of nitre and of ginger, and half a dram of tartarised antimony, may be given, dissolved in gruel.

Bronchitis is often the sequel of catarrh, or it may co-exist with it, or be produced by the same causes. It is, in fact, an inflammation of the mucous membrane lining the air-passages of the lungs, and is much more dangerous than catarrh.

The *symptoms* are, besides those of catarrh, such as cough and discharge from the nostrils, a greater diminution of appetite, and accelerated pulse and respiration. Sometimes it is produced by the presence of small worms in the windpipe, and then the cough is more frequent and distressing. This form of bronchitis is more common with calves and young cattle, probably from their being more exposed to wet and woody pastures; and when sheep are affected, it is mostly confined to young animals.

Treatment.—Bleeding may be employed in the early stages with advantage, but with some degree of moderation; and if the weakness is great, and the discharge from the nose considerable, it had better be avoided. The same dose may be administered as advised for catarrh, and should be repeated the second day; and, with the exception of the salts, it may be continued several times, diminishing, however, the quantity of nitre, and adding a dram of gentian. It is not desirable to purge in this disease, nor to diminish the strength much, but only to relax the bowels mildly: good nursing, shelter, and care, are particularly called for.

Worms in the Windpipe and Lungs.—Bronchitis, when produced by the presence of small worms in the windpipe, requires a somewhat different treatment, the object being to destroy these irritating parasites. The same means should therefore be re-

sorted to as are employed with success in young cattle, and for the following treatment we are indebted to Mr. Mayer, of Newcastle-under-Lyne. Lime-water—half a pint for a sheep, and a quarter for a lamb—should be given in the morning; and in the evening one or two large tea-spoonfuls of salt, dissolved in a quarter to half a pint of water. This treatment should be continued for the space of a week, or until the improvement becomes very decided.

Sheep are very subject to inflammation of the bronchial tubes produced by the presence of small worms as with the hoove in calves and the gapes in fowls, which diseases used to be mistaken for bronchitis. Professor Simonds considers that 'these worms, denominated the *Filaria bronchitis*, are somewhat on the increase, and are found in colts, calves, sheep, pigs, and even in dogs. Yet it is in the herbivorous animals that the worm produces the greatest amount of mischief, and particularly with calves and lambs, for young animals are far more predisposed to the attacks of parasites than the old. He exhibited one example taken from a calf and another from a pig, in which the worms were crowded together in countless numbers in the ramifications of the bronchial tubes. Of late years this worm has excited a great notice on the part of the pathologist as well as of the practical farmer, in consequence of the sad losses which have resulted from its presence amongst flocks of lambs. At present numbers of lambs are affected with it; and within the last twelve years the losses have been very serious. There has been of late an increase of entozoic diseases. Whether it has arisen from some condition of the atmosphere favourable to their propagation, he could not say; but the fact is well established. The natural history of these filariæ is well understood. They exist in the form of perfect males and females, but the females being as fifty or sixty to one. They may be called ovoviparous; for occasionally it will happen that the young worm is so perfected while the ovum is within the body of the female that it escapes from the egg, and exists as a living worm before passing through the so-called ova-duct.'

'The chief reason why the worm is so destructive to sheep and other animals, is the fact that the young worms are perfected within the part where the ova is deposited; and if one impregnated female only inhabits a bronchial tube, that female would in process of time produce such myriads of worms that the animal must inevitably fall a sacrifice; although the worms are ovoviparous, and find their proper mucus that may be coughed up—and cough is a leading symptom of this disease—they might remain as ova for an indefinite length of time upon pasture-land without losing their

vital properties or power of development; and animals feeding upon the ground may receive the eggs whilst gathering their food, from which the young worms would be quickly produced. If an animal takes anything into its mouth with which there are a certain number of ova, imperceptible to the naked eye, these ova may be retained about the mouth with the mucus or saliva long enough for some of them to be hatched. Such worms would then find their way into the bronchial tubes; the females would soon eject eggs, and the result would be a considerable brood of these creatures. Take the minutest portion of the ova-sac of a parent worm, examine it through a good microscope, and myriads of eggs will be seen. So that one worm literally produces thousands. These, getting into ramifications of the bronchial tubes, pass even to the air-cells of the lungs, where, by the irritation they create, they lead to condensation of the lung structure, and destroy it as an aerifying organ. The affected lambs fall off in condition, have a constant cough, and, gradually wasting away, ultimately become affected by diarrhœa, which usually carries them off. It is not at all an uncommon thing for 50, 60, or 70 per cent. of a flock of lambs to be destroyed from this cause.' *

'The remedies,' continues Professor Simonds, 'consists in resisting the attacks, and in expelling the cause, although, when they exist to such an extent as to produce organic change, no treatment will avail. To strengthen the constitution, the animals should be supplied with the most generous food in a concentrated form. Instead of keeping them simply upon grass, artificial or natural, during the snmmer months—for it is in the summer, or in the approach of autumn, that they are generally affected—or feeding them upon turnips alone in winter, it is necessary to throw into their system as much nitrogenous food as possible. Cake, corn, or pulse should be used unsparingly, and given early, because when diarrhœa has once set-in the system is in such a weakened condition that it will then be of little or no use.

'The cause of diarrhœa appears to depend not so much upon the mere prostration of the vital powers of the animal as a whole,

* Dr. Crisp has written an elaborate essay on this subject, which appears as a Prize Essay in the pages of the 'Journal of the Bath and West of England Society,' 1853, and is well worthy of perusal. He claims the discovery of a new worm, which he terms the *Gordius*. Dr. Cobbold, however, rather disputes the point. Be that as it may, Dr. Crisp has bestowed great attention to the subject, and has added to the facts previously known, and we must refer to his Prize Essay and his communication in 1873, accompanied by engravings, of the worms found by him.

as upon the weakened condition of the powers of digestion and assimilation.

'Nothing, indeed, is so common as to have an ordinary attack of diarrhœa just simply depending upon indigestible matter taken into the system, from which nature frees herself as quickly as she can.

'When the powers of digestion and assimilation have become exceedingly weak, the food, instead of being digested and appropriated to the requirements of the system, acts as an irritant to the stomach and bowels, and passes off undigested and unappropriated through the intestinal canal. What then, under such circumstances, would be the use of giving cake, corn, &c.?

'But while the digestive organs are not affected to any considerable extent, we may strengthen the constitution of the animal by giving it highly-nutritious food. Of the anthelmintic agents given as remedies, some are good and powerful, and some of no use at all. Practice has shown that turpentine, in conjunction with a little oil and tincture of assafœtida, is about as nice a compound as can be given.

'Turpentine, although a very old remedy, is particularly serviceable and valuable, because it is eliminated from the system through the medium of the respiratory organs.

'We want to bring something to bear as directly as possible upon the parasites in the situation which they occupy in the ramifications of the bronchial tubes; but if any medicinal agent directly descends the windpipe, it would only produce more and perhaps fatal mischief.

'The alternative is to impregnate the system with an agent which may be afterwards carried off through the medium of the respiratory organs, and thus assail the habitat of the worm. Turpentine, which, when given to an animal, is eliminated from the system partly by respiration, partly by the urinary secretions, and partly by the intestinal canal, is such an agent as we require. This is shown by the smell of the breath of calves several days after they have taken turpentine. Assafœtida is also eliminated in a similar manner, and is a useful addition.

'From half an ounce to an ounce of turpentine would be the proper dose for a calf, according to its age; half or two-thirds this to a sheep, and one-fourth to a lamb.

'Or you may take three ounces of oil, add to it two ounces of tincture of assafœtida, and one of turpentine, and administer this compound three or four days in succession, when it should be discontinued for the same space of time, and then given again, or

alternating, with the anthelmintic, ordinary tonic agents, such as sulphate of iron and ginger in combination, to give tone and vigour to the digestive organs. Sulphate of iron enters into combination with one main constituent of the blood—the red cells. There is yet another course at our command—that of making the affected animals breathe a medicated air, by driving sheep into a close shed, and there to burn something which will disengage gaseous matter, which the animal will be compelled to inhale.

'The most efficient agent for this purpose is chlorine gas; but then it is very destructive to life. The modus operandi is to decompose common salt, or oxide of manganese, with sulphuric acid, by the application of a little heat, the person holding the apparatus in the shed until the air is sufficiently impregnated to render it unpleasant to himself. If carried beyond this, great mischief might result. Another simple and safer plan is to impregnate the atmosphere with fumes of sulphur, which may be done by igniting a little tar, pitch, resin, or anything of that kind, and then throwing upon the burning mass a small quantity of sulphur from time to time. The fumes of sulphur so thrown off will pervade the place in which the sheep are, and will consequently be inhaled by them. No harm ensues where ordinary care is used.'

Inflammation of the Lungs (Pneumonia).—This disease, though we cannot consider it very common, yet occurs more frequently than sheepmasters imagine. It consists of inflammation of the substance of the lungs, and thus differs from two other diseases of the chest, for which it may be mistaken, and with which, indeed, it may co-exist—that is, pleurisy and bronchitis; the former being inflammation of the membrane covering the lungs and lining the chest, and the latter inflammation of the membrane lining the bronchial tubes. *Pleurisy* is a disease of a serous membrane, and will be benefited by bleeding; and *bronchitis* that of mucous membrane, in which bleeding can scarcely be endured.

Inflammation of the Lungs, or Pneumonia, may either exist together with one or the other of these diseases, or without them. It may be produced by a common catarrh, or the same cause that produces it, such as undue exposure to wet and cold; and thus it is apt to occur after sheep-washing.

The *symptoms* are those of fever, with quickened and laborious breathing, and hard and quick pulse. High-bred animals are more liable to this, as well as to other inflammatory diseases; and the Leicester breed is probably more disposed to it than any others; and imparts, together with its superior fattening qualities, a

greater liability to inflammatory disease to those breeds with which it may be crossed. To illustrate this, we may subjoin the following cases, related by Mr. Gutteridge in the 'Veterinarian,' vol. xiii.

'Jan. 21st, 1840.—I was requested to see a very valuable two-year-old tup of the Leicester and Cotswold breed, which I found standing leaning against the wall, his pulse hard and quick, refusing his food, rumination ceased, heaving of the flanks, painful cough, an insatiable thirst, grinding of the teeth, and constipation of the bowels. I bled him freely and gave a brisk purge, and administered injections of thin gruel every two hours, and also a small quantity by the mouth. 22nd. The cough less violent, but the medicine has not acted; respiration more disturbed, mouth hot, and total disgust of food: determined to abstract more blood, but before we could take two ounces he suddenly fell. Two hours afterwards I gave him more salts, with a little powdered digitalis in some gruel. In three hours after this I found him much relieved, the pulse not so quick, respiration less disturbed, and the bowels acted on. I ordered gruel every three hours, and injections as before. 23rd. Better, but no appetite: not so much unwillingness to move; has laid down in the night and in the morning for some time. Treatment as before. 24th. The medicine has taken effect; pulse more regular; moves about more; a little discharge from the nose; rumination returned; lies down composedly. Medicine as before. 25th. Much better; feeds; ruminates; lies down; walks about, but very weak. I ordered small doses of gentian and ginger in camomile tea, every morning and evening.

'I did not hear of him for three weeks after this, when I was informed that he had perfectly recovered, and that Mr. Powell would not sell him for a hundred pounds. I saw him a few weeks ago in perfect health, and in most beautiful condition.'

Mr. Gutteridge relates a second case, in which, though to a certain extent successful, yet, in consequence of organic disease, it was found desirable to kill the animal. 'The lungs were in a most diseased state; full of tubercles, and great adhesion of the left lung to the pleura; the liver was very soft, and much enlarged. The kidneys, and the whole of the intestinal canal, were perfectly healthy.'

This case was undoubtedly complicated with pleurisy, which would account not only for the greater severity of the symptoms, but the degree of pain manifested. It must be evident, in acute inflammation of the lungs, that the sheet anchor in our treatment

must be early and copious bleeding, repeated if necessary in a few hours. To this must follow aperient medicine, such as two ounces of Epsom salts, which may be repeated in smaller doses if the bowels are not sufficiently relaxed. Although it is not desirable to produce very active purging, there is not that danger of doing so that there is in the horse. The following sedative may also be given with gruel twice a day:—

Nitrate of potash	1 dram.
Digitalis, powdered	1 scruple.
Tartarised antimony	1 „

And so continued for several days.

Setons in the brisket will also be useful, not perhaps as a relief for the acute attack, but to counteract the chronic symptoms so frequently left behind.

If the disease is of a sub-acute character the bleeding must be less active, but the other treatment the same.

Inflammation of the lungs will sometimes appear almost as an *epidemic*, attacking great numbers at the same time; or it may with greater propriety be termed *endemic*, being more frequently confined to particular localities. In France it appears to have prevailed more extensively, and with greater fatality, than in this country, and it is in great measure attributed to the custom of keeping sheep in close unventilated sheds. There is an account of this disease by M. Roche Lubin, which destroyed a great many sheep in the winter of 1836, in Saint Afrique. 'This malady is produced by the long continuance of the sheep, during the winter, in small and ill-ventilated sheep-houses, where the floor is covered by a thick dung-heap, seldom removed, and highly infectious, and also by a sudden change from the heated air of these sheep-houses to the cold air without, in order to drink of the half-frozen water, which the thirst under which they labour induces them to take with avidity, and in great quantity. Too many sheep become diseased from this cause.

'Out of 1,100 sheep submitted to an anti-inflammatory, and yet slightly tonic, mode of treatment, a third only were saved; and they were animals that were attended to at the very commencement of the disease. The others were speedily carried off, exhibiting after death hepatization (*condensation*) of the lungs, with a complication of hydro-pericarditis (*dropsy of the heart-bag*) and diarrhœa.'

The following is also an account of its appearance in France, and is written by M. Seron, a French veterinary surgeon. He says:—

'I was called on the 30th of January, 1836, to a sheep-fold on which some unknown disease had been committing dreadful ravages. On my arrival, one of the sheep was dying. I stayed and opened him, and thought that I perceived the cause of death. Of all the maladies of the sheep, inflammation of the lungs is least understood, and yet very common. It usually appears in the months of January and February. The proprietors and cultivators of this country buy in lean sheep, in October, November, and December, in order to fatten and resell them in the course of the succeeding year. They had previously been much neglected and badly fed, and they had been driven from market to market, exposed to the intemperature of the weather. They are now suddenly placed in comfortable sheep-cotes, and have as much as they will eat, and that of stimulating food. Is it astonishing that inflammatory complaints should break out among them?

'The cause of the complaint, then, is the state of poverty in which they are bought, and the improvement of condition, rapidly, and to a great extent, acquired by means of food too abundant and too succulent, and administered without discernment, their confinement in sheep-cotes hot and ill-ventilated, and the emanations from the dung and urine too long left in them.

'The symptoms are red and injected conjunctiva, hot mouth, accelerated pulse, and laborious breathing; the muzzle of the sheep rests on the side, and the animal makes frequent attempts to get rid of a yellow mucus with which the nostrils are clogged. One symptom is remarkable and always present, namely, great tenderness of the loins. If the animal is pressed on that part, he will often fall suddenly to the ground. The duration of the malady is from twenty-four to thirty hours, and its termination is always fatal, if medical assistance is not had recourse to without delay.

'The lungs are the chief or only seat of disease. The exterior lobes are those which are ordinarily or alone affected. If they are cut into they are found to be hard, and the knife creaks as it passes through them; and if they are thrown into water they sink immediately to the bottom. Sometimes it is found in the left lobe alone, but then the whole extent of that lobe is diseased, and the other lobe is perfectly sound.*

'*Treatment.*—This must be of an antiphlogistic character. Venesection should be immediately resorted to, and repeated two or three times, if necessary, in the course of twenty-four hours. I have bled as often as three times, and in neither instance did I

* The *post-mortem* appearances here described very closely resemble those of pleuro-pneumonia in cattle.—AUTHOR.

stop the bleeding until the animal began to stagger. I have always succeeded when I have been consulted in an early stage of the disease, and adopted this course. To this were added, after the bleedings were ended, warm drinks in which a little nitre, honey, and gum arabic were dissolved—acidulated injections into the nose, in order to get rid of the adhesive mucus—emollient injections, and the sparest diet.

'The emetic tartar was given in doses of a dram, in the second stage, and I had always reason to be satisfied with it, if I abstained from bleeding afterwards.'

Pleurisy, Pleuritis.—This disease consists of inflammation of the pleura, or membrane lining the chest. It is produced by the same causes as inflammation of the lungs, with which it may be accompanied, and particularly by any sudden changes that may chill the whole system. It often occurs from this cause after sheep-washing, when it is very common to find a few sheep failing, and in proportion to the want of care exercised. It is not unusual, in examining the bodies of sheep, to find the lungs in part adhering to the sides of the chest, and the animal thus affected generally loses flesh. This adhesion is the effect of pleurisy, and another and still more dangerous result is water in the chest.

The *symptoms* of this disease are in many respects like those of inflammation of the lungs, but it is attended occasionally by severe pain, and by a variation of the symptoms generally, such as a harder and more defined pulse and more warmth of the body.

The *treatment* must consist of active bleeding in the first instance; and in this disease the sheep can bear blood-letting to a greater extent than in most diseases. The bleeding may be repeated if necessary, setons may be inserted in the brisket, the bowels moderately relaxed, and in other respects the same treatment observed as advised for inflamed lungs.

The pure Leicesters are more subject to this disease than other breeds, as the following communication in vol. x. of the 'Veterinarian,' will show:—

'A very extensive farmer and grazier, residing on the banks of the Ouse, a low and marshy district, has had the misfortune to lose many of his sheep for some years past, in the spring and autumn, from some fatal disease. By examining two or three after death, I found it to be pleuritis. There was nearly a quarter of an inch thickness of coagulable lymph on the whole surface of the pleura, and between its layers more or less serous fluid. The substance of the lungs was free from disease, as were all the other viscera. This disease has been confined to the well-bred animals, the owner never having found it in his coarse-skinned sheep. So

fatal, however, has it been in the pure Leicester, that he no longer breeds them pure, but mixes them with half Lincoln. These do not all escape, for within the past week many have died. Mr. —— has observed that the malady has been more prevalent when the sheep have been placed on cabbages and turnips: it is seldom seen when they are kept on grass or dry food. The treatment that has been adopted from time to time has been attended with no good effect; in fact, it has been directed by no very defined indication, except that of bleeding the whole flock when any case has been suspected; and when the animal is actually seized, bleeding again. Only one sheep ever recovered, and that was kept in an almost constant state of faintness for two or three days by repeated bleedings. The symptoms observed were very quick and hard pulse; breathing difficult; countenance dull; the head in a declining position, with the nose forced against the ground; bowels more than usually constipated; the membranes of the eyes and nose red; low and short cough; the animal almost always lying down, and when moved indicating much pain, and making a grunting noise. In one of the sheep there was a discharge streaked with blood from the nose.'

The attack is so rapid and sudden that treatment will probably be rarely successful. The same means, however, should be adopted as advised for inflamed lungs, the first bleeding, if possible, being still more copious. As soon as the disease appears the whole of the flock should be removed to poorer pasture, for some time only allowing the rich food for a short period of the day. It may be observed, as a general rule, that when a particular disease makes its appearance regularly amongst a flock of sheep, it is to be attributed to some faults in the feeding or management, which should be carefully searched into and discovered, as a preventive is of more importance than a remedy. A change of diet and situation is at all times desirable in such cases.

DISEASES OF THE URINARY ORGANS.

Inflammation of the Bladder (Cystitis). — Inflammation of the bladder, sometimes called *watery braxy*, is a rather rare disease with sheep, and is chiefly confined to such as are kept on artificial food, such as oil-cake, beans, &c., though clover that has been mown, it is said, will produce it. There are more losses from these causes than farmers are aware of, it being generally this disease when a sheep is said to drop with water. It is mostly confined to the male sex, and principally to rams, and such as are

highly fed. The state of the bladder appears to be that of fulness, which shows that its neck is involved in inflammation, and thus becomes contracted, and closes the cavity. In horses cystitis is generally attended with constant staling, the bladder being so irritable as scarcely to retain a drop of urine. In sheep there is the same disposition to stale, but an incapability of performing the act. Two cases are related in vol. xv. of the 'Veterinarian,' by Mr. Tindal, which proved fatal, and on examination the bladder was found not only highly inflamed, but also ruptured in both instances; the penis was also both inflamed and ulcerated. The symptoms were uneasiness, constantly shifting the hind legs, and frequently straining, as if to void the urine. The sheep was stiff and unwilling to move, and appeared to breathe with difficulty, and the action of the heart was quick and faltering. The abdomen was enlarged and tender, and there was costiveness.

Mr. Dickens, in the same volume, also relates two interesting cases, closely resembling the former in the symptoms. The first sheep was slaughtered, and the bladder was found full and highly inflamed, and there was also a lesser degree of inflammation of the kidneys and intestines. The other case exhibited the same symptoms, and the sheep being a tup, and highly fed, Mr. Dickens at once abstracted three pints of blood from the neck, which produced fainting; he soon rallied, and an oleaginous draught, accompanied by an opiate, was given twice during the day. Towards night he appeared much better, ate a little, and was seen to void some very highly-coloured urine. His medicine acted well during the night, but on the next day the straining came on at times. He again bled him from the other side of his neck to the amount of two pints. From this time he continued mending, and Mr. D. had the pleasure of seeing his patient obtain a prize as extra stock from the Huntingdonshire Agricultural Society in October.

These sheep had been highly fed on peas, cabbages, and oilcake, and Mr. Dickens is inclined to attribute the disease to the grit or extraneous matter with which the food too frequently abounds. However prejudicial this dross may be, yet we must not forget the fact that, when an animal is very highly fed, his urine becomes far more stimulating, and more abounding in nitrogenized elements, to the excess of which we should rather refer the disease.

Calculi in the Urinary Organs.—Stones are very seldom found in the urinary organs of sheep, unless they have been kept on dry food, and then they are generally found in the urethra of rams, where they sometimes cause fatal obstruction and inflammation, unless relieved by operation. The following instructive

cases are related by Mr. Stevens of Newmarket, in vol. xiii. of the 'Veterinarian.'

'Case I.,' he says, 'was a fifteen months' ram of the pure Down breed, preparing for the agricultural show at Cambridge. I met the shepherd on his road to ask my assistance. He informed me that he had a sheep with a stoppage in the water, that the present case was the fifteenth animal that had laboured under apparently the same disease, and all of whcm had either died or been destroyed.

'I found the animal down, and on his getting up observed a great anxiety of countenance, and a peculiarly sudden curvature of the spinal column; after which he passed a drop or two of urine. These symptoms had been observed continually for six hours, whenever he stood up; his respiration was also hurried.

'On casting him, and drawing out the penis, I found a small calculus forced a short distance into the appendix vermiformis, by the pressure of the urine from behind. I cut down on and removed the calculus, when the animal immediately voided the urine more freely than he was accustomed to do (as it flowed through the incision which I had made). I next administered, in the course of twenty-four hours, five ounces of sulphate of soda and a pint of castor-oil (the animal weighed about 125 lbs.), by which means his bowels were freely acted upon. In a week he went back to his pen perfectly recovered in health, and afterwards did quite as well as the others. On turning him up, however, on the following week, I found that the appendix had rotted off. Indeed, this vermiform process appears to be of so delicate a texture that it will scarcely bear touching.

'Case II. This was of a similar character. It occurred to a fellow-sheep, also fifteen months old, but a much finer animal. I found the symptoms exactly the same, and the obstructions in much the same situation. The shepherd had removed the stone before I arrived; but, much to his own disappointment, the urine flowed but a drop at a time, and these drops very slowly after each other. The same remedial means were had recourse to, but without success; for the animal became gradually worse, and it was thought advisable to kill him.

'*Post-Mortem Examination.*—The whole extent of the urethral canal was in a state of excessive inflammation, and the lining membrane so much thickened as to prevent the passing of the urine; the bladder was much distended, and it is very probable, if the animal had been suffered to live, that the disease would have terminated in rupture of that organ. The bladder was also nearly covered internally with patches of vivid inflammation, but no

earthy matter was observed. On slitting the ureters two or three small calculi were found in each, not much larger than a pin's point. I had no opportunity of examining the kidneys. I am of opinion that if this last case had been subjected to earlier treatment, the life of the animal might have been saved. I should have observed that in every case that has occurred, concretions were found adhering to the hairs round the prepuce, like small beads, of the same character as the calculi taken from the urethra.

'On analysing the stone and the concretions, they were found to consist chiefly of phosphate of lime. Sheep at grass do not appear to be subject to this complaint.'

This subject is treated more at large in a very useful Prize Essay which appeared in the 'Journal of the Royal Agricultural Society of England,' in 1867, by Mr. W. E. Litt, M.R.C.V.S., who thus writes:—'I have had considerable experience in the diseases of sheep, and many opportunities of observation, and I know only one affection of the bladder peculiar to fattening sheep and lambs. It may be that other parts of the country furnish a different class of maladies to that over which my own practice has ranged. The particular disease to which I allude is of sufficient importance to demand the most earnest attention of all who are interested. If the urine of sheep during the process of fattening be subjected to the ordinary simple test of litmus paper, it will generally be found to afford some indications of the presence of an acid. This must be looked upon as altogether an abnormal condition of things, as, under ordinary circumstances, the urine of herbivorous animals will exhibit an alkaline reaction. The effect of high feeding, therefore, appears to be to assimilate, in some measure, this particular secretion to that of the carnivora. The "exact" nature and character of the acid in question demands a greater amount of consideration than it has hitherto received; but, though differing somewhat in composition, it appears to bear a considerable analogy to "uric" or "lithic" acid; and when it is present in excess the urine, generally scanty under these circumstances, will always be found to deposit a sediment more or less abundant, and differing somewhat in character and appearance according to the exact nature of its base. For the most part, however, it may be said to consist of certain of the salts of soda, potass, or lime, with a greater or less admixture of what is known as the ammonia-magnesium phosphate, or triple salt. This morbid condition of the system is one to which all domestic animals are liable; but it is exceedingly common in fattening sheep and lambs.

'The reasons why these sandy or gravelly deposits of the urine

are more common in sheep than in other animals is due to the circumstances in which fattening sheep and lambs are placed. A high and stimulating system of feeding with an abundance of saccharine roots, want of exercise, and often a total abstinence from water, are exactly the conditions likely to produce this tendency to lithic sediments in the urine; and the peculiar construction of the urethra is such that deposits which would pass away readily enough in other animals soon begin to produce the most serious mischief in sheep. At the extreme point of the penis is a singular structure known as the "vermiform appendage," so called on account of its worm-like appearance; and the urethral outlet is here so extremely small, that the slightest calcareous deposit can with difficulty pass through it. When this lithic acid diathesis, so to speak, is present, the urethra readily becomes choked up with the sediment, the urine is filtered through it only with the greatest difficulty, coming away merely drop by drop, accompanied with much straining and other manifestations of pain and suffering. If the obstruction is not speedily got rid of, these symptoms rapidly increase in severity, the bladder becomes inordinately distended, its membrances are inflamed, and great constitutional disturbance necessarily follows. The kidneys, in turn, participate in the inflammation; the blood becomes thoroughly saturated and poisoned with urine, which may be smelt in all the secretions and tissues of the body, and the animal soon sinks under so serious a complication of diseases. Occasionally, also, rupture of the bladder may be added to the list of evils, though this result is rare, and of course fatal. It will thus be seen that what are commonly spoken of as "affections of the bladder in fattening sheep and lambs" are confined almost exclusively to male animals —that is, to wethers and rams, and in reality are not in the first instance affections of the bladder at all; the bladder is only affected by the mechanical impediment offered to the evacution of its contents through the natural channel. When the disease is found to prevail to any extent amongst a particular flock, attention must be immediately directed to the exciting causes.

'It is not easy to specify at all times the exact article of diet most in fault. Often, doubtless, it is rather a combination of several ingredients than any one in particular to which the mischief is attributable; but, as far as my own observation goes, I am inclined to think that the saccharine roots, and particularly mangold wurtzel, are especially injurious, although it must be borne in mind that those articles of food in which starch is abundantly found—such, for example, as barley, wheat, and the

like—are equally productive, under particular circumstances, oi these sabulous deposits.

'So far as is practicable, therefore, the preventive treatment must always be initiated by such an alteration of the diet as will exclude those articles which abound largely in saccharine and starchy matters, and an allowance of moderate exercise and free access to water will do the rest. The effect of a regimen like this is most marked, and I have had many opportunities of observing and approving its beneficial results. The curative treatment of the disease is a difficult matter. When dealing with wethers alone, the most economical plan is to hand over the affected animals to the butcher at once, and to arrest the further extension of the malady by preventive means; but in the case of highly-bred rams, which often possess a value beyond what the butcher would give for them, their treatment is a matter of interest and consideration.

'The following are the *symptoms* observed :—The animal is dull and more or less off his feed, holding himself aloof from his fellows, and generally lying down. When roused or lifted up, the peculiar nature of his malady will become manifest at once by the painful efforts made to pass his urine. His breathing his quickened, and he strains almost constantly, whilst only a few drops are observed to come away. If the patient be now turned up on his rump, and the penis drawn out, it will generally be found that the urethra, or at least that portion of it denominated the vermiform appendage, is choked up with sediment. This sediment differs considerably, varying from the appearance of fine gravel to that of the finest sand. Until this is removed there is little to be done in the way of remedy; and the urethral termination is so very small that to remove it is often a matter of much difficulty. When of the consistence of fine sand, however, a little patient manipulation will often be crowned with success. As there is commonly some local inflammation of the neighbouring parts, it is always advisable to commence proceedings by fomentation with warm water, after gently pressing the urethra so as to force out the accumulated deposit. Having succeeded either wholly or partially, a little sweet oil may then be applied to the parts, and a dose of opening medicine administered. Either castor-oil or fine linseed-oil, in doses of two to six ounces, according to the size and strength of the patient, are preferable to the ordinary saline aperients; and where much constitutional disturbance is present, I always add to this dose from eight to sixteen grains of the extract of belladonna. On the following day, if really necessary, the proceeding may be repeated; the

medicinal treatment should now consist of the free exhibition of some of the alkaline carbonates; and the best is unquestionably the carbonate of potass, as the salts of potass are, for the most part, perfectly soluble, and will readily pass off dissolved in the urine. Carbonate of potassa may then be given in doses of half a dram to a dram, two or three times a day, dissolved in water, either alone or in combination with belladonna or other febrifuge medicines. Air, exercise, proper diet, and the free use of water, are of the utmost importance. Physicians tell us that the lithates are sometimes thrown down, not from undue acidity of the urine, but simply from that fluid not containing the due quantity of water to hold them in solution; and that in such cases a tumbler of cold spring-water, taken night and morning, will at once cause the cessation of this morbid symptom. This fact is important; and I am satisfied that water is a most valuable adjunct to other treatment in the removal of the disease in question, and where sheep refuse to drink it voluntarily their medicine should always be largely diluted with it. It is not always, however, that the removal of the sediment from the urethra can be so easily effected. On the contrary, it will frequently be found of such a character (gritty, and of the size of small seeds) that it cannot be passed through the external opening. In such cases I have never hesitated to make an incision on the under surface of the urethra, as near the extremity as possible—generally, indeed, in the vermiform appendage itself—large enough to allow this gravel to be pressed out. Sometimes, indeed, the simplest and most desirable mode of proceeding is to remove this structure altogether. In wethers there cannot be the slightest objection to so simple an operation at any time, but in rams the case is somewhat different. I am assured, by a distinguished sheep-breeder in this district, that the commonly received opinion on this subject is an erroneous one, and that he has had many lambs got by rams which had undergone the mutilation in question.

'I am satisfied that a longitudinal incision, such as I have just described, may be made into the organ without in any way impairing its supposed functions; and there need not, therefore, be any reason to hesitate in such a course of proceeding when the circumstances of the case appear to render it necessary. By such means, with frequent fomentations and careful manipulation, the obstruction may often be removed, and the medicinal treatment already pointed out will complete the cure. It is only just to add, also, that cases will occasionally be met with in which the accumulations are so abundant, occupying not only the urethra, but also the bladder, ureters, and even the kidney itself, that no

treatment can be of any service. Such cases may always be distinguished by observing that little or no relief follows the removal of the deposit from the penal portion of the urethra, and from the greater amount of constitutional disturbance which marks their progress. Once satisfied that the extent of the mischief is such as to preclude all hope of remedy, the flockmaster must have recourse to the butcher's knife as soon as possible, as the whole system now rapidly becomes so thoroughly impregnated with urine that the meat is no longer wholesome as food.'

PARTURITION, AND THE DISEASES CONNECTED WITH IT.

Parturition.—The usual period for lambing with the greater number of sheep in this country is the months of March and April: sometimes an earlier period is attained, in order that the lambs should be sooner fatted for the market; and with the Dorset and Somersetshire sheep, the lambs are generally dropped before Christmas. It often happens that during the lambing season we have cold inclement weather; either the rain or snow of February, or the bleak winds of March prevail, and both ewes and lambs suffer much in consequence, and many are destroyed. There is no economy so thriftless in the whole range of agriculture as that which denies the ewes proper shelter at this period. They should either be driven nightly into yards or cots properly protected, or this protection should be afforded in the field by means of double rows of hurdles lined with straw, with a still more protected pound or inclosure. The shepherd or lamber should be perpetually on the watch, and the eye of the master should superintend the whole. A little manual assistance opportunely afforded, the extrication of an ewe from a dangerous position or very exposed situation, these and similar means will save a great number; and it is well observed by Mr. Price, in his work on sheep, that 'many lambs may be lost without it being possible to charge the lamber with neglect or ignorance, although greater attention on his part might save many that otherwise perish. The practice of lambing is at times very intricate, and is apt to exhaust the patience of a lamber. Sheep are obstinate, and lambing presents a scene of confusion, disorder, and trouble which it is the lamber's business to rectify, and for which he ought always to be prepared. Some of the ewes perhaps leave their lambs, or the lambs get intermixed; and the ewes that have lost their lambs run about bleating, while others want assistance. These are only a few of the various occurrences which call for the

immediate attention of the lamber, and which render it necessary that the owner of the sheep should be on the spot, and should superintend the whole concern. In the year 1805 I mentioned this to one of the greatest sheep-owners on the Romney Marsh, who said that he would watch the lamber more attentively than ever; and the consequence was, that in the following spring he was more successful than he had been in any one of the preceding twenty-five years. Another master, pursuing the same plan, saved 200 pairs of twins out of 800 ewes, whereas he had never before saved more than 100, and in some years not more than one lamb to each ewe.'

When ewes are heavy in lamb, they should by all means be kept quiet and undisturbed by dogs. The fences, too, should be kept in good order; for if chased with dogs, or from any other cause they break their pasture, there is very great danger of abortion taking place; and this evil once commenced in a flock of sheep, it is difficult to say where it will stop. At the same time they should not be too closely confined, for exercise is very essential to breeding ewes. They should be in fair condition, but not too fat; and their best place will be some good sound pasture, on which they may have a moderate proportion of turnips. If, however, the farm will not admit of this, and other feed is so short that turnips must form a main portion of their food, they should then be folded on them after the fat and young sheep, so that the greens and most succulent part of the turnips may have been already eaten, leaving only the driest but most wholesome part. It is preferable that the ewes should be somewhat deficient in condition, rather than this condition should be procured by means of turnips. It is a very useful plan (adopted by many breeders) to drive the ewes into a straw-yard every night, which, if it is at some distance from the turnip-field, will be of no consequence if they are not driven hastily. Where sheep-breeding is systematically and judiciously followed, the owner or the shepherd will be able to tell, with a tolerable degree of correctness, which ewes first took the ram, and consequently which may be expected to yean first. This will save trouble, and in many cases prevent loss, by selecting these ewes, and separating them from the others. When the important and anxious time of lambing commences, the utmost vigilance should be exercised; but, at the same time, the operations of nature must not be hastily interfered with.

The following very useful observations, from an essay by Mr. Cleeve, in vol. i. of the 'Journal of the R. A. S. E.,' are worthy of much consideration:—'The shepherd must not be led, by the appearance of uneasiness and pain, to interfere prematurely:

he must watch the ewe closely, and so long as she rises at his approach, he may be assured that, whatever uneasiness she may exhibit, all is well. Much uneasiness is generally apparent; she will repeatedly lie down, and rise again with seeming distress. If this occurs when driving her to fold, he must be very cautious and gentle in urging her. These symptoms ought to be continued for two or three hours, or even more, before he feels imperatively called on to interfere, except the lamb is in such a position as to warrant fears of losing it. In cold weather, particularly, the labour is likely to be protracted. Should the ewe appear exhausted, and gradually sinking under her labour, it will be right to give her some oatmeal gruel, with a little linseed, in the proportion of a spoonful of the latter to two of the former. When the ewe feels that she is unable of herself to expel the lamb, she will quietly submit to the shepherd's assistance. In giving her this assistance, his first duty is to ascertain whether the presentation is natural. The natural presentation is with the muzzle foremost, and a foot on each side of it. Should all be right in this respect, he must proceed to disengage the lamb, first very gently drawing down the legs, and with all possible tenderness smoothing and facilitating the passing of the head with his fingers, rather than forcibly extricating it, the particular attention of the shepherd being given to these points. This may be effected by passing the finger up the rectum until he feels the back of the lamb's head, and then urging it forwards at the same time that he gently pulls the legs. Sometimes the head is sufficiently advanced, but the legs are too backward. In this case the head must be gently pushed back, and the hand being well oiled must be introduced into the vagina, and applied to the legs so as to place them in their natural position, equal with the head. Should the fore-feet, on the other hand, protrude, they must in like manner be returned, and the same assistance given to advance the head. If the hinder quarters present themselves first, the hand must be applied to get hold of both the hind legs together, and draw them gently but firmly; the lamb may often be easily removed in this position. It is no uncommon occurrence to find the head of the lamb protruding and much swollen; but still, by patience and gentle manipulation, it may often be gradually brought forward; or even nature, not unduly interfered with, will complete her work if the pelvis is not very much deformed. Should, however, the strength of the mother be rapidly wasting, the head may be taken away, and then, the operator pushing back the lamb, may introduce his hand, and laying hold of the fore legs, effect the delivery. It also often happens that the legs are thrust out to the shoulder, and

from the throes of the ewe it is not possible to replace them so as to get up the head of the lamb. By partially skinning the legs you may disunite them from the shoulder-joint; there will then be room for the introduction of the hand, and by laying hold of the head you can deliver the ewe. A single season of practice will do more than volumes of writing, to prepare the farmer for the preceding and some other cases of difficult labour. But let him bear in mind that, as a general rule, the fœtus should, if possible, be placed in its natural position previously to any attempt to extricate it by force. When force must be used, it should be as gentle as is consistent with the object of delivery. I need scarcely observe that the ewe must be the object of careful nursing and care until she is completely restored.

In an excellent Prize Essay contained in vol. xii. of the 'Journal of the R. A. S. E.,' Mr. Sibbald makes the following remarks:—

'Almost every shepherd considers himself an adept at lambing his ewes; and when, from a false presentation, or twins, or an unusually large-sized fœtus, causing protracted parturition, he thinks himself called upon to interfere, he proceeds to extract the lamb at once, without regarding the violence used, and the manner in which he accomplishes his object—his object being, at all hazards, to bring the fœtus away from the mother. The symptoms after these operations are usually great prostration of strength; the animal is unwilling to rise; in a few hours she begins to breathe quickly; the ears,nose, udder, and legs are cold; the external genitals are swollen and intensely red, and there is a bloody serous discharge from the vagina. As the disease progresses the breathing becomes panting; the ewe throws herself prostrate on her side; her paunch is filled with gas; the extremities and udder are deathly cold, and the blood-vessels on the latter are filled with congested blood, causing a dark blue colour; the genitals have now also become cold, and the colour is changed to a purple, the head is drawn back to the spine, and, after a few convulsive struggles, she expires. When an ewe separates herself from the others, and is evidently about to lamb, no long time should elapse before the shepherd satisfies himself if this act has been accomplished; and if it has not, he should gently ascertain if there be any presentation; that is, if any portion of the lamb has advanced into the vaginal passage; if it has, he should further ascertain if it is coming in a natural position, with the head and fore-feet first; if so, he may leave her to herself, and no harm will accrue. If the presentation be a false one, he should at once proceed to facilitate delivery, and the assistance of an experienced operator should be

immediately obtained. After delivery, a small quantity of digestive ointment or liniment should be introduced into the cavity of the vagina, with a view to counteract a typhoid or gangrenous tendency. If great force has been used, or the labour has been protracted, with much consequent exhaustion, half-a-pint of oatmeal gruel with a gill of sound beer, warmed, and from two to four drams of laudanum, should be administered, and repeated at intervals of three or four hours, the same quantities of nitric ether being substituted for the laudanum if the pain is not so violent, and the animal seems to rally a little. But if the ewe is not much distressed at the onset, two ounces of Epsom salts, with two drams of laudanum, will form the proper medicine, gruel being supplied to her occasionally. When the ewe appears to be recovering she should be shut up in a house for several days, and if her lamb be alive, it should be returned to her; but if it be dead, and there is no substitute lamb for her, the udder should be drawn with the hand for a few days. The parts may be dressed occasionally with the digestive, or, if much fetor is present with sloughing, the solution of chlorinated lime may be used. Any lesions of the labia had better be drawn together by suture; although, if slight, they usually heal readily. The *placenta* is sometimes retained in old and weakly ewes, or after manual assistance has been afforded in the extraction of the fœtus, and its decomposition goes on rapidly. Some tonic medicine, composed of a gill of warm beer, with from two to four drams of nitre, two drams of powdered gentian, and a little ginger, will form the best cleansing drench; and if the membranes have not come away on the following day, they should be gently pulled with the hand, and often in a few hours they will be expelled.

The last subject to be noticed is *retention of the fœtus* in the uterus; and this occasionally occurs in the ewe. Sometimes even no parturient pains at all will be observed, but the fœtus can be felt with the hand through the walls of the abdomen; in other cases the throes will come on about the usual period of parturition, but the fœtus will not advance from the womb, and no assistance can be rendered until there is a presentation. These pains gradually abate, and in the majority of cases the ewe will fatten rapidly, the fœtus being found after she is slaughtered, generally in an almost natural state, although, if much time has elapsed, the process of absorption will, to a certain extent, have taken place. The intrinsic value of the ewe will rarely balance against the risk of future loss. A word or two may be said as to the condition of ewes at the lambing season; and observation has confirmed the opinion that, however much a plethoric condition

conduces to disease in wethers and stores of all kinds, yet the reverse obtains with the pregnant ewe. The flock that has been badly kept, the animals being poor and lean at the time of parturition, will be the flock in which the greatest losses both of ewes and lambs take place.

The increased value of sheep renders it more important than ever to bestow great attention at the period of lambing, so as to save as many lives as possible.

The following useful hints on the subject are given by Professor Tanner:—

'The fold enclosed by the double row of hurdles is divided into two generally equal portions from east to west, and on the north side of the fold a series of little pens are made, each being about one hurdle square, and these are also separated by straw and double hurdles, and enclosed in front by an ordinary hurdle. If the ewes were going to lamb at the rate of fifty a week, I would have twenty of such pens made; and if the room on the north side of the fold is not sufficient, then use the east side in the same way; thus a favourable aspect is secured, and, by the temporary roof thrown over, the sheep have thus an excellent shelter prepared for them. The whole is well littered with straw.' In view, however, of the facility with which shedding can be erected, and its comparative cheapness, it is questionable whether it would not be the better plan to have regular sheep-sheds constructed in which the lambing could be carried on.

Shelter could be also provided for the shepherd, and every accommodation afforded him in case of sickness of the ewes or of the lambs. In the shepherd's shed a fire should be able to be made; for, as Professor Tanner well remarks, many a lamb has been saved by being brought to a fire when it has been dropped in rough weather, and has got chilled. The same authority recommends that the shepherd should be supplied with a stock of milk for weakly lambs, and also with gin and peppermint, to be used as cordials where required.

Abortion.—Though not so common as in cows, this disease, as it may be termed, sometimes occurs very extensively, and becomes of serious consequence to the sheep-owner, disarranging all his plans, as well as occasioning a severe pecuniary loss. It may occur at all periods of pregnancy, but is most frequent when the ewe is about half gone. The causes of abortion are various—sudden fright, jumping over hedges or ditches, being worried with dogs, and the two free use of salt, have all been known to produce it; but that which causes it more than anything else is the unlimited use of turnips and succulent food. Many farmers may have doubtless been in the habit of permitting this with

impunity, and would therefore be disposed to doubt the evil consequences of the practice; but it is not in every season that it is attended with danger: but when vegetation has been abundant in the autumn, and the winter has been unusually wet, there is considerable probability of the ewes casting their lambs. Such has been the case after a wet autumn in numerous instances in this county (Hants), which have come under my own particular attention. One farmer had nearly a hundred aborted, and lost a good many of the ewes. They had been turned on a fine field of turnips, and subsisted entirely on them and water-meadow hay for some time previous to the commencement of the mischief, which began soon after Christmas and continued for several weeks. Though the greater number of ewes recovered, yet they suffered much, and some died from inflammation of the womb, and others became paralysed.

The *symptoms* first manifested are dulness and refusal to feed: the ewe will be seen moping at a corner of the fold, and will be heard to bleat more than usual. To these succeed restlessness, and often trembling, with slight labour pains; and in the course of twelve hours abortion will have taken place. Sometimes the parts will be so relaxed, that the uterus or vagina will become inverted, and the expulsion of the placenta will precede that of the fœtus. In the flock before alluded to the lamb was almost universally dead, and often exceedingly offensive, and the abdomen was distended with a bloody, watery fluid, pointing out pretty clearly the nature and source of the disease.

The *treatment* to be adopted is of two kinds, preventive and curative; the former, however, is the most important. In the first place it is imprudent to turn ewes in lamb into turnips; they should have instead some dry pasture, and be well supplied with hay. If feed is short, the turnips may be drawn and given them on the ground in moderate quantities; or what is better, cut up and mixed with chaff or bruised corn in troughs. It is better that the condition of the ewes be in some degree impaired, than that so great a danger as abortion should be incurred. If this precaution has not been observed, and abortion should appear, what then is to be done? The flock should be removed from the turnips to a dry pasture, and supplied with the best hay on the farm; the aborted parts should be carefully buried, and the ewe removed from the rest; and, if possible, the same man that attends the flock should not touch or go near the abortion, for there is very considerable danger from infection. The ewe should be placed in a sheltered situation, but allowed plenty of fresh air, and the following medicine may be given with some nourishing gruel:—

Epsom salts	½ ounce.
Tincture of opium	1 dram.
Powdered camphor	½ "

The two latter medicines may be repeated the following day, but not the salts, unless the bowels are confined.

The immediate cause of death in fatal cases is inflammation of the uterus or womb.

Dropsy of the Abdomen.—Another bad effect arising from the too free use of turnips and succulent food is dropsy of the abdomen of the ewe, which gradually increases in size, and at length, about a few weeks before parturition, produces death from weakness and exhaustion.

In other cases the lamb is born alive, but soon pines away, refuses to suck, and dies in a few days with the abdomen distended with serum—*water-bellied*, as it is commonly termed.

The only thing that can be advised in the latter case is prevention, by the avoidance of the exciting causes; but dropsy in the ewe has been relieved by the operation of tapping, and though in such cases our prognosis must be extremely doubtful, yet the following case appears to sanction favourable hopes:—

This singular and, we believe, original operation was performed at Laxton, by Mr. Esam, of that village. 'A ewe sheep was almost dying from the effects of dropsy, when Mr. Esam proposed that he should be permitted to try the effects of tapping. His suggestion being approved of, he made an incision in the side of the animal, into which he introduced a piece of elder as a tube, and took from the sheep not less than eight gallons of water. It soon began to revive, and soon regained perfect health. The ewe was four years old; the pasturage on which she had been fed consisted of low ground. The incision was made on the right side, about four inches down the flank. The ewe has done well since the operation, and there does not appear to be any return of the disease.'

A Disease previous to Lambing.—Although the ewe throughout the greater portion of the period during which she is with lamb is in a good state of health, and often enjoys an immunity from diseases, such as the rot, &c., to which other sheep are liable, yet as the period draws near she becomes susceptible to various diseases, some anterior, though more subsequent to parturition. Of the former, the following communication to vol. xiv. of the 'Veterinarian' affords rather a singular instance:—

'A nobleman, a very extensive agriculturist and grazier, has within a few days lost several of his best true Down ewes just ready to drop their lambs. There are several hundreds of the true

Leicester and Down Leicester breeds in the same flock, but they are all doing well at present. They are pastured on a fine rich elevated park, the feed short, folded at night, and allowed good hay. The best of them are generally the first and the most severely attacked.

'*Symptoms.*—They stray from the rest of the flock, lie down, toss their heads, and grind their teeth. If suddenly disturbed, they jump up, and then frequently topple heels over head. They at length, however, rise, or lie and look dull, sleepy, and stupid. They walk stiffly, and with their bellies tucked up; and after going a little way they lie down and are unable to rise. The appetite is lost, and rumination ceases. The pulse and respiration are little affected, except when the animals are excited. The legs and ears are generally warm, and the mucous membranes are of their natural colour. The disease generally terminates fatally about the fifth day from the first attack. A few that have been bled seem to rally a little, and are certainly better. They were all bled when the disease first appeared.

'*Post-mortem Examination.*—The liver very pale, of a light yellow clay colour, and containing but little blood. *The Lungs.*—The parenchymatous substance filled with thousands of minute, round, red, or yellow spots, from the size of a pin's point to that of a pin's head. When cut into, they contain either blood or yellow serum, in some few pus: but from their minute size it is difficult for me to describe them. *The Brain.*—In that part of the dura mater opposite to and just below the frontal sinuses, there was a black and soft effusion, easily wiped off. The substance of the brain was a little softened, but otherwise healthy. Every other part of the animal was minutely examined, and was perfectly healthy. The sheep were rather fat for breeding sheep, and two fine lambs were in each. The stomachs and intestines were healthy and contained but little food.'

The most singular part of this account is that the disease was confined to the true Downs, whilst the Leicesters and the half-breds escaped. Now this is precisely a different result from what we should expect with regard to inflammatory diseases, the Leicesters being more disposed to disease of this nature. The Downs are also considered to be better mothers and nurses. We can scarcely suppose that the richness of the feed could have been the cause, as the sheep were folded at night (unless they were allowed the hay then as well as by day, which the writer does not mention), and the herbage in the month of March is not particularly nutritious.

The symptoms denote cerebral disease, or affection of the brain from sympathy with the digestive organs, and the examination

after death supports the former supposition. The true Downs being alone affected might be an accidental circumstance, and possibly they might have had previously chronic disease of the lungs and liver. In the absence of a favourable solution of the cause of this disease, we should recommend a change of pasture, less hay and a few turnips instead, as precautionary measures, if a similar disease should make its appearance; and with regard to remedial treatment, blood-letting, and a dose of salts, with a seton at the back of the head.

Inversion of the Uterus.—Though this occasionally takes place in the ewe at any period, from sudden severe exertion or straining hard, yet it is most frequent immediately or very shortly after parturition. In this case it arises from the violent spasmodic action of the womb, which turns inside out, and protrudes out of the sheep.

No time should be lost in replacing it. The ewe must be placed on her back, with her hind parts somewhat elevated; and the hands being lubricated with oil or lard, the uterus should be gently forced back into its natural situation. A stick of metallic wire or leather should then be passed through the bearing, so as to prevent a second protrusion, and yet to admit the urine coming away. Twenty to thirty drops of the tincture of opium should be given in a pint of gruel, and the ewe kept perfectly quiet for several days.

Heaving, or After-pains.—This disease is often a severe loss to sheep-breeders, not unfrequently carrying off the pride of their flocks, even when the labour has been natural, and the lamb yeaned without difficulty. Lord Braybrooke states, that on some farms near Saffron Walden the mortality from this disease is 4½ per cent. The spasmodic pains arise from the violent contraction of the womb, and the effort of nature to restore it to its natural size. It is much more severe with the second or third lamb than the first, because each time the womb becomes more dilated, and requires more contraction; and though, to a certain extent, it is a healthy operation of nature, it often passes beyond the bounds of health and becomes disease. It usually appears about the third day after parturition, and the first symptom is generally a frequent and painful disposition to expel her urine, which is high coloured or bloody. She breathes quick, lies down, and appears to have spasmodic pains; her ears droop, and she takes no notice of her lamb. On pressing her hind parts she yields, and almost sinks to the ground; and if she moves, it is with pain and difficulty. The hind parts often swell, and mortification follows, when the pain in a great measure ceases, but is soon followed by death.

When the pains are not inordinate, it is better not to interfere with nature; but when otherwise, the *treatment* must consist principally in the administration of sedative medicine, the best combination of which will be the following:—Take

Camphor	$\frac{1}{2}$ dram.
Tincture of opium . . .	$\frac{1}{2}$ ounce.

Mix. To be given with gruel; repeating the dose, somewhat diminished, in a few hours.

The spasm often continues in spite of treatment, and inflammation of the womb supervenes; and it occasionally prevails almost as an epidemic, destroying sometimes a good portion of the flock, as the following communication to vol. xii. of the 'Veterinarian' will show. The writer, after stating that he had tried bleeding and Epsom salts ineffectually, observes:—'We are losing at this time 20 per cent. The attack commences from six to thirty hours after parturition, and includes those who have experienced a difficult labour, and others who have given birth to their lambs without any assistance.

'The *symptoms*, when first noticed, are, continual shifting of their posture, lying down and getting up again immediately, the ears hanging down, and the eyes looking dull. Sometimes partial or almost universal palsy ensues, and mortification of the womb terminates the poor animal's sufferings. I have tried bleeding a few days previous to their lambing, and immediately after parturition, but neither did any good. The sheep are not in high or low condition; some of them have been living on Swedes, and some on white turnips, but they have never had a great quantity. The turnips are very good for the season, without much green top. They have also at times had salted hay. When we first began to lose them, we attributed it to the north-east winds, and the quantity of snow that fell at the time; but we were wrong in this, for we are losing them now that the wind is south-west.'

A similar mortality has prevailed with many other flocks, and mostly on farms where it is customary to keep the ewes pretty much upon turnips. In the above instance we are inclined to think that the disease must be connected with the turnip diet, assisted perhaps by the salted hay. Though both are excellent for fattening sheep, they are neither to be recommended for ewes in lamb: to them hay should be given without salt, and a dry pasture is more suitable than the turnip-field, where a moderate quantity of turnips may be given that have been drawn a day or two, by which means much of the watery portion will have been

evaporated. If no pasture of this sort is available, the ewes in lamb should follow after the fatting sheep have been folded on the turnips, so as to have the driest portion of the roots.

Parturient Fever in Ewes.—Under this term Mr. Isaac Seamen, in a Prize Essay contained in vol. xv. of the 'Journal of the Royal Agricultural Society of England,' relates his experience with various flocks of sheep, and thus describes the *symptoms*. The earliest symptoms that mark the commencement of this disease are—first, the ewe suddenly leaves her food, twitches both hind legs and ears, and returns again to her food; during the next two or three days she eats but little, appears dull and stupid; after this time there is a degree of general weakness, loss of appetite, and giddiness, and a discharge of a dark colour from the vagina; whilst the flock is driven from fold to fold, the affected sheep loiters behind and staggers in her gait, the head is carried downward, and the eyelids partly closed. If parturition takes place during this stage of the disease, and the animal is kept warm and carefully nursed, recovery will frequently take place in two or three days; if, on the contrary, no relief is afforded, symptoms of a typhoid character present themselves; the animal is found in one corner of the fold, the head down, and extremely uneasy; the body is frequently struck with the hind feet, a dark coloured fœtid discharges continue to flow from the vagina, and there is great prostration of strength. A pair of lambs are now often expelled in a high state of putrefaction, and the ewe down and unable to rise; the head is crouching upon the ground, and there is extreme insensibility; the skin may be punctured, and the finger placed under the eyelids, without giving any evidence of pain; the animal now rapidly sinks and dies, often in three or four days from the commencement of the attack. Ewes that recover suffer afterwards for some time great weakness, and many parts of the body become denuded of wool.

Treatment.—The ewe immediately noticed ill should be removed from the flock to a warm fold apart from all other sheep, and be fed with oatmeal gruel, bruised oats, and cut hay, with a little linseed cake. If in two or three days the patient continues ill, is dull and weak, with a dark-coloured fetid discharge from the vagina, and apparently uneasy, an attempt to remove the lambs should be made. The lamb in many cases at this period is dead, and its decomposition is a frequent cause of giddiness and stupor in the ewe. If the *os uteri* is not sufficiently dilated, it and the vaginal cavity should be smeared every three hours with the extract of belladonna, and the following medicine should be given:—

Calomel	8 grains
Extract hyoscyamus	1 dram.
Oatmeal gruel	8 ounces.

Mix, and give two table-spoonfuls twice a day.

Epsom salts	8 ounces.
Nitre	½ ounce.
Carbonate of soda	2 ounces.
Water	1 pint.

Mix, and give two wine-glasses full at the same time the former mixture is given. Let both mixtures be kept in separate bottles, and well shaken before given. The bowels being operated upon, omit both former prescriptions, and give the following:—

Nitre	½ ounce.
Carbonate of soda	1 ounce.
Champhor	1 dram.
Water	8 ounces.

A wine-glass to be given twice a day. Feed the ewe principally upon gruel and milk, or linseed porridge. Parturition having taken place, the uterus should be injected with a solution of chloride of lime, in the proportion of a dram to a pint of warm water, and repeated twice a day whilst any fetid discharge from the vagina remains.

Garget.—This disease, which is an inflammatory affection of the udder, is less frequent in the sheep than in the cow. It may be produced by lying in the cold and wet; and it is stated also by the hardness of the ground, or from constitutional derangement. It will first be denoted by disinclination or refusal to allow the lamb to suck, and one or more of the teats will be found red and tender and swollen, and sometimes the udder itself will, even at this stage, be found wholly or partially enlarged, and hard knots or tumors will be felt.

An ounce or two of Epsom salts, with a dram of ginger, should be given the ewe, dissolved in warm gruel or water, and the udder should then be fomented with water as hot as she can well bear it for some time together, and the lamb may afterwards be allowed to suck her. The fomentation, if necessary, should be repeated, and then the camphor ointment may be rubbed in twice a day. If the swelling continues, and matter forms, it should at once be opened by a free incision, and the escape of the pus assisted by pressure and renewed fomentation. If the wound smells in the least degree unpleasant, it should be syringed with a weak solution of chloride of lime for several days.

The garget sometimes makes its appearance suddenly, and in so formidable a manner, that it becomes fatal in the course of

twenty-four hours from the supervention of mortification. It should be met by the most active treatment, and the *constant* application of a hot fomentation. A not unfrequent cause of inflammation of the udder is from a ewe having twins, and one of them having been taken from her, and the other lamb allowed to suck from the same side as before, as it generally will; the consequence of which is, the milk accumulates on one side, and inflammation follows. This effect can of course be obviated by the shepherd obliging the remaining lamb to suck from both teats. The udder of every ewe should be examined by the shepherd immediately after yeaning, in order to ascertain whether milk can be drawn readily from both teats. It should also be observed afterwards from time to time, as early attention will in many cases save the ewe from this troublesome and dangerous disease.

Sometimes, from the effects of garget, some portion of the udder becomes hard—schirrous, as it is termed—and of course no longer secretes milk. Such a ewe should invariably be drafted and fatted. In more favourable cases, or perhaps simply from soreness of the teats, their openings become closed, and the passages impervious; and this is only discovered after the ewe has had another lamb, and it attempts to suck. An endeavour should first be made to insinuate a small probe into the entrance, but if this fails, a knitting-needle should be made red-hot, and with this an opening should be made, taking care not to carry it deeper than necessary, nor to deviate from a straight line. After this the lamb, by frequent sucking, will keep the passage clear.

Garget, or inflammation of the udder, observes Mr. Sibbald in his prize essay elsewhere quoted, is of frequent occurrence in the ewe, but its effects are not so serious as in the cow, for the ewe is only wanted to supply sufficient milk for her lamb, and it is seldom that the animal with twins is effected. The only primary source of this complaint is the liability before noticed of the fever always attendant upon parturition becoming localised, or determined to some particular organ. The proximate or determining causes are, lying on wet lairs or pastures, or when the early spring nights are frosty. Mechanical injuries are but very rarely the cause of the affection. It is injurious to force the teats much, as, when the disease is fully established, the secretion from the gland is nearly suspended. A dose of physic—from two to three ounces of Epsom salts—with two drams of ginger to insure its purgative action, should be administered. Bleeding will hardly be called for. There is less ability to bear disease in the ewe than in the cow, and it will be unable to bear the adoption of debilitating remedial measures. Fomentations should be applied to the udder twice daily; the

wool should be clipped away, and goulard-water applied. The ewe must be housed and supplied with some clean soft litter. In many cases the animals are all folded at night, but the shelter of the ailing one should extend even to the day. The diet may consist of turnips, hay, and a few bruised oats. After the operation of the physic, provided the disease be not checked, some medicine of a diuretic and febrifuge nature will be desirable. From two to four drams of nitre, with two of cream of tartar, may be given once each day, dissolved in a few ounces of chilled water. If the swelling of the gland is stayed, and there is less heat, the teats should be drawn twice or thrice in the day provided there be a secretion of milk; but the lamb should not be too soon returned to her. If, on the other hand, the heat is very great, some portion of the gland will soon be found to soften; pus is forming here; and as soon as a fluid can be distinctly felt, the part should be well laid open; but in the meantime the soap liniment, or what is better, some black oils, may be diligently rubbed in twice in the day, after fomenting. If the pus evacuated is of a white colour, it should be well squeezed out, and the wound dressed with the digestive; but if a fluid or thick grumous matter is discharged, and the wound appears of a livid hue with fetor, gangrene has probably commenced. The wound may be washed out with the chloride of lime, and afterwards dressed with the compound tincture of myrrh; the contiguous portions, which may rot or become a dead stinking mass, may without fear be removed with the knife, stimulants afterwards being freely applied. These wounds will often heal with great rapidity. If the whole of the udder be a mass of disease, it may be removed by tying a sufficiently stout ligature tightly round its base, close to the surface of the belly. If the constitution suffer, as evidenced by loss of appetite and rumination, with quickened breathing, it is to be feared that the gangrene is extending to the system, and the restorative plan of treatment, under the head of Gangrene of the Womb, should be resorted to. The ewe that has suffered from any disease of the udder should be fed for the butcher, unless the recovery is perfect and the ewe of peculiar value. Inflammation of the udder from retention of the milk, and an inefficient supply of nutriment to the lamb; in these cases the lamb had better be taken away for a day or two, and suckled from the can; the ewe will not secrete so much milk when the lamb is absent, and the teats may be drawn twice in the day by the hand.

The following account of a disease occurring amongst ewes is rather of an unusual kind. It appears in a communication from

the owner, Mr. Buckley, in the 'Journal of the R. A. S. E.' He says:—'Several ewes have been attacked with a disease which turns out, after death, to be an affection of the liver. This organ appears as if it had been parboiled, and is in the first stage of decomposition; the gall-bladder is unnaturally full; but the rest of the intestines are in an apparently healthy state. Sometimes a violent purging comes on, and the complaint throughout is accompanied with great debility. Condition seems to have nothing to do with it, as those in high, as well those in low, have alike been attacked with it; it is confined entirely to ewes at different periods after parturition, varying from fourteen days to a month, or longer. Not a fluke has been discovered in their livers, or any other symptom of "rot" whatsoever. I think in some cases the disease fixed itself on the udder, with less affection of the liver; but it has terminated fatally in every instance: some have died in forty-eight hours, others have lingered a fortnight. Calomel and other purgatives have been tried; in cases where great debility existed, stimulants of different kinds have been tried; but all to no purpose.' The above account having been submitted to Professor Sewell, he observed:—'It appears to be a chronic disease of the liver, produced by continued wet weather, and leaving the constitution so much debilitated, that the secretion of milk required to nourish the lamb as its growth advances increases the debility, until exhaustion ensues, under which the animal sinks. Both the depleting and stimulating treatment having failed, I think mild tonics should have a trial. Dissolve half an ounce of sulphate of iron in a quart of hot water, and give-half a pint twice a day. To check purging, give one ounce of finely-powdered common chalk in half a pint of water daily, if required. Keep under shelter, and give dry food, and a lump of rock-salt to lick.'

Mr. Sibbold observes:—

'A form of hysteritis sometimes makes its appearance in two or three days after parturition. The ewe is attacked with *after-pains* and *straining*, consequent either upon exposure to inclement weather, or from the determination of the accompanying fever of parturition to the uterus. In the first stages of this complaint the nose is hot and dry, the breathing but little accelerated, the udder hot, swollen, and tender; the labia are everted and of a scarlet hue; the ewe moves restlessly about and ceases to graze; she is annoyed by the attempts of her lamb to suck, and kicks it away.

'The symptoms enumerated in the other variety of the disease now rapidly set in; or, from contiguity, the peritoneum, or membrane lining the cavity of the belly and clothing the womb, becomes inflated; fluid is effused into the cavity of the belly; the ewe

seldom rises unless disturbed; her breathing is heavy, and she appears dull and depressed, death ensuing in two or three days. In many parts of the country this affection is known by the name of *Redwater*, from the colour of the fluid found upon opening the body. The treatment at the commencement of this complaint must be blood-letting—from four to eight ounces, if so much can be obtained, should be abstracted from the facial vein. There are few shepherds but can perform this operation, but there are still fewer who take any care as to the quantity of blood abstracted. This should not be the case. When the vein is made visible by pressure over the angle of the lower jaw-bone, the opening should be made with a lancet in an oblique direction into the vein, the blade of the lancet being of tolerable size. This will allow the blood to flow more freely than if the opening be made longitudinally, in a direction with the course of the vein. The sheep should be held, pressure being still applied to the jaw until such time as the operator considers enough blood has been evacuated, the blood being caught in some suitable vessel. Should the blood continue flowing after the pressure has been abandoned, the edges of the wound may be pinched together with the fingers and a strip of adhesive plaister laid on. The professional attendant will alone be competent to bleed from the jugular, and he will rarely find it necessary to open this vein in preference to that of the face. After bleeding, the saline purgative, with laudanum, as before noticed, should be administered; or, if the bowels be relaxed, two ounces of linseed-oil with the laudanum should be substituted, the udder and shape being well fomented. If there is frequent straining, a dram of the extract of belladonna rubbed down with an ounce of warm water may be injected into the vagina with a suitable syringe. If the sheep obstinately persist in lying down, and the breathing is much hurried, the wool should be clipped from the lower surface of the belly and the flanks up to the udder, and a sufficient quantity of mustard, mixed with spirits of turpentine to a thin consistence, should be rubbed in. The ewe must be placed in a comfortable house, and, if food is refused, small quantities of thin oatmeal gruel should be occasionally administered; but a few slices of turnips or mangold wurzel may be allowed, if she will eat them, and a little barley-flour with cut hay. She should yet be carefully nursed and sheltered for a few days; but if symptoms of gangrene appear, the restorative plan of treatment before recommended must be adopted. Any inordinate flux from the bowels should be corrected by the administration of chalk in half-ounce doses with the other medicines, always retaining the full doses of laudanum.'

DISEASES OF THE SKIN.

The parasites which infest sheep are numerous, and are thus classified:—The *Epizoa*, which live on the skin; the *Entozoa*, which infest the internal structures; and the *Ectozoa*, which inhabit both internal and external parts for a time only, whilst undergoing certain changes through which they pass.

Lice, ticks and mites, are examples of the former, the most formidable of which is the *Acarus ovis*—the cause of scab.

Hydatids are, perhaps, the lowest forms of animal life. One called the *hydatis cellulosæ*, because it infests the cellular tissues, is that which is found in the pig, causing measly pork, which, when partaken of by human beings, and particularly if insufficiently cooked, produces tape-worm in the intestines. That which infests the brain of sheep is called the *cænurus cerebralis*, thus called from having a number of sucking discs.

The solid worms are called *sterelminthæ*, and consist of many varieties, including both the tape-worm of the sheep and other animals, and also the *distoma hepaticum*, the cause of the rot.

Scab.—This troublesome and loathsome disease is analogous to the mange in horses, and the itch in man. It is decidedly contagious, and when it extends considerably amongst a flock, it is occasioned by infection, although filth and poverty will also produce it. It is not so much, however, the actual contact of the sheep, as the rubbing on the same post, or other object, which produces it, and thus it has been communicated to a sound flock after the affected sheep had been all removed.

The first symptom which calls attention to an affected sheep is the itching, the animal rubbing itself against any object; and it has been ascertained that the sheep begins to rub about twelve days after having received the affection. It will then be found that on the part affected pustules will be visible, and the skin will feel rough and the pimples hard. In a few days the pustules are broken by the rubbing, and a fluid escapes, which soon becomes dry, and forms the scab, which gives the designation to the disease. This scab, if rubbed off, exposes a sore which may thus increase, and spread over a good portion of the body, the wool being denuded; and in the summer the fly will attack the sore, and the maggots eat into the flesh, and form deep sinuses, which bid defiance to every remedy.

It has now been pretty clearly shown that the scab, like the itch in man, and the mange in horses, is caused and propagated by means of minute insects called *acari*. These insects are of both sexes,

and no larger than the hole formed by a pin or needle of medium size; they burrow under the skin, producing great irritation; and when the pustule dries they leave it for another part, and thus extend the disease over the body, or propagate it by contact with another animal. The mode in which this is accomplished has been pointed out by M. Walz, a German, who observes: 'If one or more female acari are placed on the wool of a sound sheep, they quickly travel to the root of it, and bury themselves in the skin, the place at which they penetrated being scarcely visible, or only distinguished by a minute red point. On the tenth or twelfth day a little swelling may be detected with the finger, and the skin changes its colour, and has a greenish blue tint. The pustule is now rapidly formed, and about the sixteenth day breaks, and the mothers again appear, with their little ones attached to their feet, and covered by a portion of the shell of the egg from which they have just escaped. These little ones immediately set to work and penetrate the neighbouring skin, and bury themselves beneath it, there finding their proper nourishment, and grow and propagate, until the poor animal has myriads of them to prey on him and to torment him, and it is not wonderful that he should speedily sink. Some of the male acari were placed on the sound skin of a sheep, and they, too, burrowed their way, and disappeared for a while, and the pustule in due time arose; but the itching and the scab soon disappeared without the employment of any remedy.' It therefore appears necessary that both sexes of the acari should be present in order to propagate the disease to any extent, and then such are the prolific qualities of the female (from eight to fifteen being produced in a litter), that we cannot wonder that the disease should spread so extensively. It is stated by M. Walz that the insect will even retain its life throughout the winter, although the greater number perish previously; and this agrees with the fact which we occasionally find that the disease breaks out in the spring in animals that were thought to be cured. We also find that the disease is generally more rife at this period of the year, and the irritation produced is greater than in cold weather.

The theory which the German writer unfolds explains readily one of the fertile causes of this disease, but there is greater difficulty in accounting for the manner in which it is frequently engendered. We well know that poverty is a most fertile predisposing cause, whether the disease be engendered or taken by contagion. But in the former instance this appears to be in obedience to a law which obtains throughout nature, that when

the powers of vitality in an animal are materially diminished, it becomes the habitation of other beings possessing life; thus we find flukes in rotten sheep, worms in the intestines and windpipe, and the acari in the itch and mange. We can ascertain these facts, but are still in the dark as to the real origin of this and similar diseases.

The *treatment* of this disease consists in destroying the obnoxious insects, and therefore requires a local application. There are many that have been found successful, but all demand much trouble in their employment. Perhaps one of the most simple, as well as the most effectual, is that of dipping the sheep in an infusion of arsenic, half a pound of which will be sufficient for twelve gallons of water. The infusion must be thoroughly applied to the skin, which it should reach, as well as saturating the wool; and this will be greatly facilitated if the sheep is previously washed with soap and water. Care must, however, be taken that the head is not dipped, otherwise great danger will be incurred from the mixture entering the lungs. Convenient apparatus is now sold for the purpose, together with a prepared mixture for a solution, and it has met with the approbation of many agriculturists, and been exhibited at agricultural societies.

Another mode of cure, but attended with more trouble, is the application of mercurial ointment. One part of strong mercurial ointment being mixed with from three to five parts of lard, should be applied by parting the wool and rubbing it into the furrows from the head to the tail, and about four inches apart.

The following ointment, applied in the same manner, will generally be effectual. Take

Lard, or palm oil	2 lbs.
Oil of tar	½ lb.
Sulphur	1 „

The two latter ingredients being gradually mixed together, the former should then be rubbed down with it.

The following has also been successfully employed, but being very powerful, should not be applied too freely:—

Corrosive sublimate, powdered . .	½ lb.
White hellebore, powdered . . .	¾ „
Whale, or other oil	6 gallons.
Resin	2 lbs.
Tallow	2 „

The two first ingredients to be mixed with a little of the oil, and the rest being melted together, the whole to be gradually mixed.

Tobacco-water is another remedy which has been found

effectual, but the high duty it is subject to limits its application. A pound of common tobacco may be infused or boiled in about eight gallons of water, and thoroughly applied, the skin being first well cleansed with soap and water.

Dipping.—Great care should be exercised in the dipping of sheep: we have known many deaths occur indirectly from the employment of arsenical compositions, sometimes from the sheep being turned on pastures when wet from the dipping, and so poisoning the grass; at other times deaths have occurred from other animals and poultry getting access to the mixture after it has been used; great care should, therefore, be exercised as to its disposal. Sulphur alone, although useful as an addition, is not strong enough to be relied on alone. In Australia, where, from the great number of sheep and dearness of labour, the subject has been well studied, tobacco, which is there cheap, is combined with advantage. Mr. J. Armand thus speaks of it in the 'Veterinarian,' June 1862:—

'A bath is made which contains 1 lb. of tobacco and 1 lb. of sulphur to every 5 gallons of water, and into this the animals are plunged. The mixture is always kept as warm as the animals can bear it, avoiding, of course, extremes. Coppers are erected to boil the tobacco, after which the decoction is placed in a large dip or receptacle, and the sulphur is then added. These dips are constructed of various sizes, and sunk in the ground. The heat of the mixture is kept up by the addition of hot liqour, and partly by the bodies of the sheep themselves. The dips should not be too large, as there is then a great difficulty in keeping up the temperature of the fluid. If too small, however, there is a danger of the sheep striking on the bottom, when precipitated into the receptacle from the pen above. A good size is that which will hold ten or a dozen comfortably at one time.

'Having filled the bath, the first lot of sheep are sometimes thrown in one by one until it is full; but mostly they are precipitated from the pen, situated above it, by tipping the floor. Men are placed around the bath, who keep the sheep moving about, and occasionally, by means of crutches with which they are furnished, they push the heads of the sheep under the water. The sheep are thoroughly soaked in three or four minutes. The door communicating with the "run" is then lifted up, and the sheep pushed through it into this passage. On the door being again let down, the dip is ready for another lot. They find their way from the "run" into the draining-yards, which are paved and slightly inclined. These yards being two, the upper one is first filled, and the gate then shut. The lower one is next

filled; and when this is done, the sheep in the upper yard are allowed to go away, those in the lower one taking their place. By this plan we ensure the sheep being thoroughly drained, and also save a good deal of the dipping mixture.

'It is necessary to add fresh liquor from time to time, to keep up both the heat and proper strength, and also to supply the place of that which has been used. The amount required will depend very much upon the length of the animal's wool. The sulphur is kept floating in the bath by the agitation of the fluid, by which means it settles in the wool, acting, I have no doubt, as the chief preventive of scab. When this disease exists it is usual to dip the sheep again at the end of a fortnight; but, in my opinion, one thorough soaking is sufficient, if done in hot liquor. The tobacco is best boiled in bags, as it is then easily removed from the copper when its strength has been extracted. Leaf tobacco is, I think, the best; but all the common sorts are used. Many of the settlers grow their own tobacco; but rather more of this is required, it not being very strong. The strength recommended is rather considerable, if the tobacco is good. It would be more prudent to prepare with double the quantity of water.'

Professor Simonds gives the following as an useful formula for an arsenical bath :—

Take of arsenic ½ lb., soft soap ½ lb., carbonate of potash 4 ozs., and water 20 gals.; boil the arsenic and the potash together in one half of the water, dissolve the soap in the other half; afterwards mix together for use. This will make a bath sufficient for twenty sheep. It should be used moderately warm, as it will then be found to be more efficacious in the destruction of parasites, and less hurtful to the sheep than plunging them into the fluid when cold.

A common sulphur bath may be prepared with soft soap 1½ lb., carbonate of potash ½ lb., sulphur 2½ lbs., boiled for half an hour in 20 gals. of water, which will be sufficient for twenty sheep, and they should be kept in for some minutes.

There are many useful and harmless preparations sold by chemists and others that may be used with advantage for dipping sheep. Although sulphur is useful as an addition, particularly where the scab is feared, yet from its very slight solubility it is for the most part merely suspended in watery decoctions or infusions. The different forms of carbolic acid have been employed with great success, and are very harmless and safe. The Messrs. MacDougall have given the subject much attention, and their preparations are highly recommended.

Sheep are liable to another disease of the skin, which often

puts on an erysipelatous character. It is attended with much itching, but occurs more suddenly, and consists of an inflammatory affection of the skin, which causes small blisters full of red and watery fluid. These of course break, and a scab forms of a black colour. This disease has in some places received the term Red-water, which is very objectionable, inasmuch as two other diseases have received the same designation.

The *treatment* consists in a cooling purgative, and, if necessary, some blood may be also taken, and a little oil or lard applied to the scabs.

Cutaneous inflammation is occasionally more severe than that above described, or appears in other forms, and even as an epidemic: it has been denominated the Wild Fire (*Ignis sacer*).

Black Muzzle is a local term given to a cutaneous eruption of the nose, which extends up the face. It is probably produced by the acrid nature of some of the plants which form the pasture in particular localities. It may be cured by means of mild mercurial ointment, or the following:—Take

Sulphate of zinc, finely powdered .	1 ounce.
Hog's lard	1 lb.

To be rubbed up together.

The Variola Ovina, or **Small-pox** in sheep is, unquestionably one of the most formidable and fatal diseases which has ever visited the flocks of this country. Though new to Britain, it has long been known on the Continent, where its ravages at times have been very extensive. Our freedom from it is due, perhaps, to our insular position, and the non-importation of sheep for a long course of years. It has, however, visited us in a severe form. Its first appearance in this country can be readily traced to certain Merino sheep imported in July 1847, in several vessels, and sold at Smithfield, where they were first seen by the unfortunate buyers. One of these vessels, the 'Trident,' came from a port on the coast of Denmark; and a few days afterwards the 'Mountaineer' and the 'Princess Royal' landed a number of sheep from Hamburg. The greater portion of these sheep were poor and apparently adapted for stock-sheep, for which purpose they were purchased in various lots by different agriculturists in various parts of the country. This appears to be the earliest introduction of the disease into any part of this country. But it is very probable that, in the course of the following month, other diseased cargoes were imported, and the infection still further spread. The disease appears to have raged mostly in the eastern counties of England, and those in the vicinity of the metropolis. The

symptoms were a dull and moping appearance, dulness of eyes and swelling of eyelids, succeeded by reddish spots in the naked places. In a few days, what was called the papular stage commenced; swellings resembling flea-bites appeared, varying in size from one-fourth to an inch in diameter; in mild cases moderately red and circumscribed; in severe cases, of a purple hue, and sometimes running into each other. There are thus two kinds of the disease—the distinct and the confluent; the latter being always the most severe. It should be borne in mind that nearly 150,000 sheep were imported into this country in 1847. The disease appeared about ten days after the animals were purchased. In an inoculated case it took from ten to eleven days to show the papillæ; the same in a case of exposure; this papulation lasted to the sixteenth day; vesication to the nineteenth; suppuration (which, in a majority of cases, did not take place in sheep) to the twenty-second day; and desiccation to the twenty-eighth. The disease was certainly both contagious and infectious. Its contagious character was shown by the facility with which it spread by inoculation; and its infectious nature by the fact that other sheep had been attacked in the immediate vicinity of the diseased ones; and also when, some little time afterwards, they had been placed in pens where the affected ones had previously been put. What, then, it might be asked, was the nature of the disease? It was an animal poison, that produced great fever and destroyed all the functions of the system. At present they could lay down no laws for its treatment. If a child were inoculated with the matter of this small-pox, as it is called in sheep, it had this singularity —it produced a disorder exactly corresponding with the cow-pox. The trial had been made, and duly recorded. In Lincolnshire and Norfolk the disease had been very fatal; the mortality had been dreadful. The destruction in some cases had amounted to 95 per cent. A German agriculturist (Captain Carr) had published a statement to the effect that the disease had swept off every sheep in a village near which he resided. No one, in certain districts, seemed to have any immunity from it. The greater number of deaths occurred in the early stage of the disease; and when it was very rife in a flock, the sheep died off without any external manifestations, as if they were poisoned. If they lived over this stage, they are still in great danger of dying in the third stage. The disease is greatly increased by exposure to wet.

When the first edition of this work was printed, in 1844, this disease had not appeared in this country; but as it had often prevailed in France, we felt it necessary to call attention to it, and describe its symptoms and character. That this was necessary or desirable,

the fact of its breaking out extensively a few years subsequently is a sufficient proof. We then called attention to the failure of vaccination as a preventive, and to the much greater success of inoculation when the disease made its appearance in a district, and sufficiently mild cases could be selected from which to procure the necessary lymph.

The disease is by no means an unmanageable one; for it does not appear to be infectious until it can be readily detected by examination of the skin where it is denuded of wool. If, therefore, this examination is carefully adopted, it may be detected and extinguished. This daily examination is, however, very troublesome, and there is danger of the infection being propagated by the attendant. When the disease broke out in this country in 1848, there was no system of inspection or means for preventing the spread of the disease, and consequently its ravages were very extensive. On its more recent introduction a close and almost daily inspection soon stopped the progress of the disease, by slaughtering the affected animals. In the earlier outbreak, inoculation was adopted in many instances when the cases were getting numerous. In other instances a daily examination and separation was sufficient to stay its progress. The benefit of the former proceeding was that the duration of the disease in a flock was limited to a certain time; and by selecting mild specimens for the matter the per centage of deaths might be reduced very much. On the other hand, by turning and inspection daily, and resorting to this at the earliest period, the mortality might be rendered still less; but there is greater danger of keeping up the disease, and often a longer time in getting quit of it. There cannot be a doubt, however, that the plan now adopted is the best—that of not only turning and inspecting the flock daily, but also destroying every affected sheep, and so stamping out the disease. The inspection requires to be repeated, but there is no justification for slaughtering the remainder of the sheep merely because they had been in contact with the diseased, which would be the case with cattle-plague, as the danger of infection is by no means so great.

The Tick, Fly, &c.—Sheep are much exposed to the attack, and suffer much from the effects, of various insects and vermin. One of the most common is the *Tick*, which, though commonly about the size of a pea, is sometimes much larger. This is a very active insect, possessing six legs, and running with much speed it attaches itself to the skin by means of sharp claws at the extremity of the legs, and pierces the skin with sharp instruments attached to the head. The tick propagates rapidly, and is often found in great numbers on a single sheep, selecting the neck and shoulders in preference to other parts.

In the 'Journal of the R.A.S.,' vol. i., second series, p. 43, Professor Simonds gives an elaborate account of the sheep tick and other parasites affecting the skin, to which we must refer our readers. The former is thus described in the 'Micrographic Dictionary':—

'*Melophagus ovis*: antennæ small, sunk in an eye-like cavity of the head; eyes small, oval; setæ three, enclosed in two sheath-like, hairy, unjointed organs (*labial palpi*), resembling otherwise those of pulex, and arising from the sides of a triangular labium. Legs robust; tarsi with two stout serrated claws, each having at its base a blunt process; accompanying the claws is an elegant feathery tarsal brush, and on the under side of the last tarsal joint is a bilobed pectinate organ.'

It may be destroyed by the application of turpentine, linseed-oil, or mercurial ointment, or dipping in a solution of arsenic. Lice are sometimes a source of much annoyance, but may be destroyed by mercurial ointment, solution of arsenic, or tobacco-water.

The *Fly* is a still more formidable enemy, causing more irritation, and leaving behind more severe effects. It abounds mostly in woody localities, and in the month of May deposits its eggs on the sheep, selecting a sore, if there is any to be found, which is often the case, particularly about the head. The maggots being hatched, burrow under the skin, causing severe irritation, and producing frequently extensive and troublesome wounds. The sheep exhibits much uneasiness soon after being struck, often stamping, biting themselves, and running about the field with much violence. The wounds, if neglected, soon spread, and I have known the most severe and complicated fistulous wounds produced thereby, extending between the shoulders and becoming incurable.

The most simple preventive to the attack of the fly is the application of coarse whale-oil to the parts most likely to be attacked. The fly has such dislike to even the strong *smell* of the oil, that it acts as a safe protection, and is much more simple than the application of a plaster, as sometimes practised. A striking instance of the effect of the oil is mentioned by Mr. Hogg in his 'Shepherd's Guide.' As a local application, immediately after the sheep have been struck by the fly, white lead is one of the best, and it will also act as a preventive. It is rendered still more effectual when mixed, as in the following recipe, and on being scattered over the parts will speedily destroy the maggots:—

White lead	4 ounces.
White arsenic	1 ounce.
Sulphur	6 ounces.
Cinnabar of antimony	2 „

Each to be finely powdered, and the whole then well mixed. It may be rendered weaker, and perhaps more suitable, when employed as a preventive, by diminishing considerably the proportion of arsenic.

The following is the application formerly used at Holkham successfully in the flocks of the Earl of Leicester:—

White arsenic . . .	$1\frac{1}{2}$ ounces to 1 gallon of water.
Soap	3 ,, ,,
Tobacco	2 ,, ,,

The arsenic is boiled in a bag, and kept stirred at the time of boiling. The tobacco is also boiled in the same manner, and put into the water when cold. The soap is cut in thin slices, and the whole of the mixture boiled for half an hour. One pint and a half to be applied to each sheep.

Earl Spencer observes: 'It is better to dip the lambs immediately after the ewes are shorn than after weaning. The shearing the ewes destroys or removes the ticks which were upon them, and the dipping destroys those which were upon the lambs; whereas, if it is postponed till the lambs are weaned, the wool on the ewes will have then grown long enough to shelter ticks, which have come upon them from the lambs after the time of shearing.'

If the sore, from inattention or neglect, has spread, the application of the following astringent powder will be desirable:—

Prepared chalk	6 ounces.
Alum	1 ounce.
Armenian bole	1 ,,
White lead	1 ,,
Chlorine of lime	1 dram.

Each to be finely powdered, and the whole well mixed together.

The Gad-fly (Œstrus ovis).—One of the most annoying insects (at least temporarily so) by which sheep are attacked is the *œstrus ovis*, or gad-fly, which in the summer months abounds in woody places. These insects have two wings, and somewhat exceed half an inch in length and near a quarter of an inch in width when full grown. They deposit their eggs on the inside of the nostrils, which the sheep endeavour to prevent by holding down their heads and flocking together. When the fly succeeds, the sheep becomes half frantic, and often races about the field with extreme violence. The eggs thus deposited are soon hatched, and the little maggots crawl up the nostrils, in doing which they produce great irritation to the poor sheep, and enter the frontal or other sinuses, where they remain increasing in size until the fol-

lowing spring. They are supposed to live on the mucus secreted by the membrane which lines these cavities; and whilst in these abodes they do not appear to give any inconvenience; but after remaining till the following April they make their exit from these sinuses, and crawl down the nostrils, in doing which they again prove a source of great irritation, causing the sheep to sneeze, toss their heads, and stamp with their feet. The insect then burrows in the ground, and its skin becoming hard and of a dark brown colour, it appears as a chrysalis. In from six to nine weeks it again assumes the form of a fly, and has sexual connection with a fly of the opposite sex. The male soon afterwards dies, sometimes, however, impregnating several females; and these, after depositing their eggs in the manner before described, soon terminate their existence.

Little can be recommended either as a preventive or a remedy. Some whale-oil smeared on and round the nostrils is, however, the most likely method of keeping off the attack of the fly.

Sore heads is a term used to express the injury inflicted in part by the irritation of the fly causing the sheep to scratch its head with the hind feet, and in part by the fly itself afterwards attacking the wound and causing it to spread sometimes to a great extent. The fly is of a different species, and smaller than that we have before spoken of, but may be also kept off by means of the whale-oil. When, however, the sore is very extensive, the best plan is to apply some common sticking-plaster to the wound, and cover the whole with a canvas cap, having loops to admit the ears, and tape to tie under the chin and throat.

The Louse of the sheep is denominated *Trichodectes ovis.* Professor Simonds thus speaks of it:—

'In some cases which have come under our observation these lice have been present in very large numbers. They appear to show a preference for the inner part of the thighs, and arms, and sides of the neck of the sheep. Their location in the latter situation often induces the animal to thrust its head between the bar of gates and horizontal rails to seek relief from the irritation by rubbing—a circumstance which occasionally has led to its becoming fixed and strangled. If the wool be broken, or short, and detached in places, and if the sheep nibble its flanks and other parts of its body, and scratches its elbows with the hind feet, as in scab, an examination should be made, which will often be rewarded by a discovery of the parasites. Sulphuretted oil will be found efficacious in destroying these lice, besides which the use of an agent of this kind during the winter months is more prudent, as sheep cannot now be safely dipped. In-lamb ewes must

also be freed from the parasites in the same manner. Some persons add an eighth, or even a sixth, part of mercurial ointment to the oil, which is, however, objectionable when much of the surface of the body has to be dressed over. The increased efficacy of the mixture does not compensate for the risk which is incurred. Many other agents might be named for the destruction of these lice, but it is not necessary to do so, the utility of sulphuretted oil being so well established.

SPECIFIC DISEASES.

The Rot.—This disease is one of the most ancient, as well as one of the most destructive, with which sheep are attacked. For centuries past we have accounts of its formidable ravages, arising unquestionably in all ages from keeping these animals on soils not intended for them by nature, unless improved by means of drainage. The sheep, for the most part, is naturally an inhabitant of high and dry situations, and it is only by art, and attention, and skill, that he has been made to thrive and increase in rich and lowland pastures. For the last few years, however, our flocks have been in great measure exempt from the visitations of this disease; it has, as it were, given place to other epidemics still more extensive, though less fatal.

Though a million of sheep or lambs have frequently been destroyed annually by this disease, in the winter of 1830–31 this number, it is supposed, was more than doubled—some farmers lost their whole flocks, others a moiety, and many were ruined in consequence. These facts were proved before a committee of the House of Lords in 1833, and it was there stated by one farmer that he lost 3,000*l.* worth of sheep on his farm, in Kent, in the course of three months. Even at this time there were 5,000 less sheep taken to Smithfield every market-day in consequence of the mortality two years previously, so extensive and general had it been. On the Continent, and in America, the mortality has been as great in proportion as in Britain, and even in the settlements of Australia its ravages have been felt. In Egypt, on the borders of the Nile, it rages with a degree of virulence to which Europe affords no parallel. MM. Hamont and Fischer, in an essay on the subject, translated in vol. vii. of the 'Veterinarian,' informs us that 'It assumes its most serious character after heavy rains and extensive floods, and in wet countries covered with aquatic plants. It affects animals of different ages, and in all seasons. It appears every year in Egypt after the fall of the

Nile, and it follows and keeps pace with the subsidence of the waters. In the superior parts of Upper Egypt it commences about the end of July; near Cairo, in August; in the environs of the capital, in October and November; and during the months of December, January, and February, in the Delta. It is most obstinate, and continues longest, in the neighbourhood of the confluence of the waters; in Lower Egypt it lasts about 120 or 130 days, and it disappears soonest, and is least fatal, when the rise of the Nile has not been considerable. Desolation and death accompany it wherever it passes. The Arabs say that this pest annually destroys 16,000 sheep in Egypt. Its victims usually perish on the twenty-fifth, thirtieth, thirty-fifth, or fortieth day after the apparent attack.'

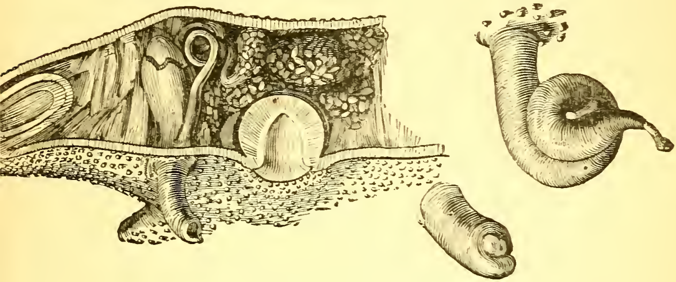
The first *symptoms* attending this disease are by no means strongly marked; there is no loss of condition, but rather apparently the contrary; indeed, sheep intended for the butcher have been purposely cothed or rotted in order to increase their fattening properties for a few weeks—a practice which was adopted by the celebrated Bakeley. A want of liveliness and a paleness of the membranes generally may be considered as the first symptoms of the disease, to which may be added a yellowness of the caruncle at the corner of the eye. Dr. Harrison observes, 'When, in warm sultry and rainy weather, sheep that are grazing on low and moist lands feed rapidly, and some of them die suddenly, there is fear that they have contracted the rot.' This suspicion will be further increased if a few weeks afterwards the sheep begin to shrink, and become flaccid about the loins. By pressure about the hips at this time a crackling is perceptible now or soon afterwards, the countenance looks pale, and upon parting the fleece the skin is found to have changed its vermilion tint for a pale red, and the wool is easily separated from the pelt: and as the disorder advances the skin becomes dappled with yellow or black spots. To these symptoms succeed increased dulness, loss of condition, greater paleness of the mucous membrane, the eyelids becoming almost white, and afterwards yellow. This yellowness extends to other parts of the body, and a watery fluid appears under the skin, which becomes loose and flabby, the wool coming off readily. The symptoms of dropsy often extend over the body, and sometimes the sheep becomes *chockered*, as it is termed—a large swelling forms under the jaw—which, from the appearance of the fluid it contains, is in some places called the watery poke. The duration of the disease is uncertain; the animal occasionally dies shortly after becoming affected, but more frequently it extends to from three to six months, the sheep gradually losing flesh

and pining away, particularly if, as is frequently the case, an obstinate purging supervenes. In Egypt, where the disease is more virulent and rapid, the symptoms are more marked, and the swelling under the throat is more uniformly present. 'If an Arab shepherd,' observes M. Hamont, 'is asked how he distinguished this disease from all others, he replies that they have under the jaw a bag full of water; they walk with difficulty; have diarrhœa; their wool falls off; they are dull, disinclined to move, and almost constantly lying down; sometimes a fetid matter of a variable colour, yellow, grey, or green, runs from the nose. The head, and neck, and belly, and limbs, swell; the eyes are red; they become thin; they eat and drink little when the disease is in an advanced state, but rumination continues for a considerable period.'

The appearance after death depends much on the stage in which the sheep is destroyed. In five or six days after contracting the rot, the thin edge of the small lobe of the liver becomes of a transparent white, or bluish colour, and this spreads along the upper and lower sides, according to the severity of the complaint; sometimes it does not extend more than an inch above the margin. If not in an early period of the disease the flesh is found very pale, and a yellow serous fluid infiltrated in various parts of the body, and the abdomen often contains a similar fluid. In the latter stages there are few parts of the body free from disease; the lungs are often studded with tubercles, and the heart is soft and pale; but in all cases we find the liver extensively affected, sometimes pale and easily broken down, in others mottled like the back of a toad, containing hard scirrhous spots, and sometimes a fluid-like jelly is deposited in different parts of its surface, but particularly round the bile-duct and hepatic vessels; and upon boiling the liver loses its firmness, and separates into pieces, and continues soft and flaccid.

These are appearances that may vary in different subjects, and many of them may be considered to be owing to the progress of the disease itself; but the appearance which we find, either more or less, is the presence of *flukes* in the ducts of the liver. These flukes have been considered to constitute the essence of the disease, although it must be observed that there are some respectable writers who consider them to be an effect and not a cause, and this doctrine would seem to be borne out by the opinions and observation of MM. Hamont and Fischer, who, in their *post-mortem* examinations, do not mention the presence of flukes, and who believe the disease to be owing to the superabundance of water taken into the system with the food. The

liver appears to be the only, or the principal locality, for these parasites, and sometimes its ducts are entirely full of them, upwards of 700 having been counted, whilst in other livers a few only could be found. They resemble in shape the fish called *plaice*, or sole, and are from half an inch to upwards of an inch in length, and rather less than half this in breadth in the middle, from which they taper to the head and the tail. The following description, with the engraving, was supplied by the late Professor Morton to the 'Veterinarian,' vol. xii., and kindly offered for use in the present work:—



At the extremity of the head will be perceived an orbicular opening, which I suppose must be designated the mouth of the fluke. This Mr. Sowerby, however, has not been able to trace beyond the representation here given of the animal, nor have I been more successful. It is possible that the parasite possesses the power of projecting this tube-like body, which now is in a state of retraction. In a dried specimen it resembles a small slit. It is certainly a circular opening, inclining somewhat to the inferior surface, both in the recent animal and in those preserved in spirits. Just below this is seen a small projection. In some flukes this is very indistinct, and at first induced me to think it marked the difference of the sexes; farther investigation convinced me of my error, for it may be found in all in a greater or less degree of development. Sometimes it is coiled upon itself; and within its opening two minute globular bodies may be seen, seemingly attached by filaments. Is this the ova-duct? There can be no doubt of its connexion with the ovaria; and it seems to make up part of the complex genital organs which render the animal hermaphroditic. The eggs themselves, whether within or without the animal, are interesting microscopic objects. As the

latter, they may be obtained in abundance from the liver of a rotten sheep, by diluting the bile with water, and then separating them by means of a filter. There can therefore be no doubt of the truth of your (the editor's) statement that the eggs are frequently received in the food. Having been discharged with the dung, they remain on the grass or damp spot on which they may fall, retaining their vital principle for an indefinite period of time.

'Immediately beyond this prolongation may be observed another opening, called by some the *ventral opening*, but which, in reality, is a sucking disc; and consequently some entomologists have given the name of *Distoma hepaticum* to the parasite. It is composed of strong muscular fibres, and is imperforate, or, at least, it has no traceable communication with the internal parts of the animal. The question naturally arises, Does this parasite receiving this aliment by one tube, after having absorbed the nutritious particles from it, return it by the same, as do the polypi, and other animals even still lower in the scale of organization, even the nomads?'

Mr. Morton was unable to discover any traces of eyes; and it is not at all probable that these residents of a locality never penetrated by light actually possess any.

It is important to ascertain to what these parasites owe their origin, and in what manner they enter the liver, where they are almost invariably found.

There were several theories on the subject, some attributing them to the miasma of marshy situations, believing that the mischief is inhaled by the lungs; others considered that the eggs are taken with the food alone, and that these eggs are only found on the dung of rotten sheep, the combined action of the sun and moisture preserving their vitality, and in which state they are swallowed with the grass by other sheep, and being hatched in the stomachs and intestines, crawl up the ducts of the liver. It is unquestionably the fact that the rot is produced where water is exposed to the influence of the sun; and that neither a running stream, nor land entirely under water, or quite dry, will produce it. It is equally true that the eggs in countless numbers may be found in the dung of rotten sheep. Thus though all agree as to the agency of moisture in producing the disease, there is much difference of opinion as to its *modus operandi.*

Some consider that it is produced by marsh miasma—by emanations proceeding from the soil and entering the system by means of the lungs.

Then there is the theory of the eggs of the fluke being deposited

with the dung, and preserved from destruction by warmth and moisture, and swallowed by other sheep.

There is also the opinion that the disease is to be attributed to the taking into the system a superabundance of watery food, thus surcharging the body with aqueous matter, diluting the blood, and producing the train of symptoms that are met with; others ascribe it to a plant growing on boggy soils, called Sheep-rot weed.

Numberless facts have sufficiently proved that the rot does not occur on a sandy, chalky, or porous soil, or on land altogether under water, nor if completely dry. But on land retentive of moisture, or having pools of stagnant water, rot is very likely to appear. It occurs in wet summers to a much greater extent than in dry, and it has therefore been much less prevalent during the last few years.

Most of the theories respecting its introduction may now be set at rest by the researches that have been made in the natural history of the fluke.

Professor Simonds, in his exhaustive article on the rot in sheep in vol. xxiii. of the 'Journal of the R. A. S. E.,' thus refers to the natural history of the liver fluke, which we may justly regard as the true cause of rot:—

'**Distoma hepaticum** or **Fasciola hepatica**.—The name *Fasciola* was originally bestowed on this entozoon by Linnæus, while that of *Distoma* was adopted by Retzius, under the belief that it was furnished with two distinct mouths. The term hepaticum is employed in conjunction with distoma to signify that the entozoon is met with in the liver. The distoma belongs to the order Trematoda which denotes that is a suctorial worm, and is placed in the second family of this order.

'**Form and Size**.—The *Distoma hepaticum* varies in size in the same animal, according to the age of the entozoon. Although this is the case it is a singular circumstance, hereafter to be explained, that no distomata are found, even in long existing cases of rot, so small as to warrant the belief that they had been hatched within the biliary ducts. The form of the entozoon is that of an oblong oval, flattened from side to side. Its greatest breadth is anteriorly, immediately behind the central sucker, from which point it gradually tapers to its tail. When fully developed, the distoma will attain a length of an inch and a quarter, and a breadth of half an inch. Many of the smaller specimens, however, are somewhat rounder in form. On being removed alive from the biliary ducts, the creatures are seen to contract themselves, so as to appear very much smaller than they really are—which has often

led to an incorrect conclusion with regard to their real size and age, and the length of time they had been located within the ducts.

The colour varies according to the amount of bile contained within its digestive system; it being dark-brown or brownish hue if full, and if nearly empty of a yellowish-brown.

Judging from analogy there appears no reason to doubt that the siliated embryo of the *Distoma hepaticum* does not undergo any material change until becoming parasitic to water-snails, slugs, &c., when it becomes converted into a peculiar organism called a *Cercaria-sac.* From the nucleus of the distoma-embryo development goes on, and a brood of young *cercariæ* are ultimately formed within the sac, by a species of successive budding, each one in turn thus becoming a parent. From the first, second, or third of these offspring a return to the form of the original parent distoma takes place.

This system of propagation has been described most accurately by Steenstrup, who has named it 'Alternation of Generation,' as differing materially from ordinary metamorphoses. We give his own definition of the process. 'Alternation of Generation is,' he says, 'the remarkable phenomenon of an animal producing an offspring which at no time resembles its parent, but which, on the other hand, itself brings forth a progeny which returns in its form and nature to the parent animal; so that the maternal animal does not meet with its resemblance in its own brood, but in its descendants of the second, third, or fourth degree of generation.' The cercariæ were for a long time considered as infusoria when found to be floating in water, their origin and mode of propagation being unknown until the discovery of Steenstrup. The cercaria-sacs were designated by him 'nurses,' and the young cercariæ developed within them 'patent-nurses'—terms which have helped rather to mystify the matter than to render it plain.

Most cercaria-sacs are of simple organisation, but they are found of various forms, according to the kind of cercariæ developed.

When first set free from the sac, the cercaria is rather tardy in its action; but after a time it swims freely about, assisted in its various movements by the length of its tail. In the most perfected cercariæ no sexual organs can be detected, although in other respects their resemblance to distomata is so complete.

It is evident from this that they have to undergo a higher form of development, which they can only attain by becoming entozoic to other creatures. Some varieties of them have been observed to bore their way into water-snails, to cast off their tails,

and develop into flukes, thus forming the series of changes. After entering the body of the snail, and before being transformed into the fluke, the cercaria rolls itself into a little ball and passes into the pupa state, by emitting from the surface of its body a mucous secretion which encloses it.

Encysted cercariæ, besides adhering in large numbers to a great variety of mollusca, the larvæ of aquatic insects, &c., are likewise found free in water. How long their pupa state may continue is not known; but, according to the experience of Steenstrup, in some varieties of cercaria it does so 'for many months.'

Although distomata are so widely diffused, it is an established fact that ruminating animals are more frequently affected with them than others, and sheep most of all.

Encysted cercariæ received with the food of ruminants are not at once exposed to the solvent action of the gastric juice, but are detained for an indefinite length of time within the rumen and the other preparatory stomachs whose secretion is non-digestive. Within these organs, therefore, no special cause of destruction to the vitality of the cercariæ exists, and hence a great number of distomata are perfected, ultimately to find their way into the bile-ducts by passing first into the true digestive stomach and onwards into the duodenum.

The converse is the case with herbivora with single stomachs, in which encysted cercariæ, on entering the digestive system, are immediately exposed to the action of the gastric juice, by which many have been destroyed, and do not reach their proper habitat—the liver.

This circumstance may account in part for the well-known fact that horses graze almost with impunity on pastures where both oxen and sheep become affected with flukes. Nevertheless, distomata have now and then been found in the horse and also in the ass. The late Professor Sewell discovered some flukes in the ass, specimens of which are preserved in the College Museum. Mr. Pritchard, M.R.C.V.S., Wolverhampton, also found flukes in the liver of a horse. They have also been found in man as well as in other animals.

The two causes which render sheep so susceptible to the entozoa are its natural habit of feeding close to the ground and its being a ruminating animal. With an elevated temperature combined with excess of moisture, cercariæ, which would otherwise perish are brought to perfection, abounding wherever the ova of flukes may have been conveyed. Lands liable to flood are therefore the most dangerous, as the overflowing of rivers and brooks brings upon them these infusorial creatures in countless

numbers. They may be conveyed in some of their metamorphoses, and in forms more or less active by innumerable means, some of which would be scarcely suspected. In considering these causes, the long duration of the vital principle in the ova of the liver-flukes, of which notable examples have been given, must not be lost sight of, nor must the fact of the millions of ova which are constantly being cast from out of the intestines of rotten sheep and other animals, in all situations and under all circumstances.'

Symptoms.—In the early stages of rot the flukes simply act as irritants to the liver, and induce it to increased performance of its functions, by which the animal thrives at a greater pace than before; but presently this is succeeded by structural changes and impaired functions, and at the same time the further development of the fluke actually robs the animal of that which would in a normal state nourish and increase the fat and flesh of the body, so that the blood, deprived of its globules and red particles, becomes watery and weak, so that the membranes become pale and white, which may be shown by everting the eyelids, and is one of the early and prominent indications of rot. Increased thirst and a failure and uncertainty of the appetite, with irregularity of the bowels, succeeds, with gradual loss of condition. Watery swellings succeed, particularly round the throat and lower jaw; a cough, increased weakness, quick breathing and stupor, pave the way for the final termination.

The time occupied by the disease varies much, being under unfavourable circumstances very brief, whilst in others, with nutritious food and dry land, it may extend through the following summer. There are very numerous cases on record which prove that sheep may contract the rot in a very short space of time, even in passing from one dry farm to another, provided they have in their passage cropped the pasture off some marshy land for the space of an hour or two.

With abundance of wet and a high temperature the rot can be produced at any time during the summer, or from May to October; but it is in the autumn months that the symptoms of its existence are usually apparent. The danger appears to disappear with the first appearance of frost.

With regard to the *treatment* of rot, it is well to consider the object we have in view. A perfect cure is almost hopeless; and it would be very imprudent to keep animals, supposed to be affected, for breeding purposes. The object should be to make the most of the animal for the purpose of the butcher. To give the most nutritious and blood-forming food, containing plenty of only such as linseed-cake and pulse, with which may be com-

bined vegetable and mineral tonics, such as anise-seed and sulphate of iron:—

Sulphate of iron	1 dram.
Salt	½ "
Anise seed	½ "

May be mixed with half a pound each of linseed-meal, quarter of pound each of peas and locust-beans, and given daily to each sheep; and of course a calculation could be made for a larger number in the same proportion.

It is well known that salt is fatal to the fluke, and that sheep may feed on salt marshes with impunity. It is therefore of consequence that salt should be freely offered to sheep, for it is not only inimical to the fluke and the early stages of its development, but supplies soda for the blood. Farmers are too neglectful of this. Rock-salt should be always accessible, and it is more particularly demanded during a wet season.

EPIZOOTIC DISEASES.

Influenza.—This disease is, in the sheep as well as the horse, of a peculiar kind; it is not simple catarrh, or even epidemic catarrh, but an affection of the mucous membranes generally, and is attended with much prostration of strength. It is probably infectious, and its attack usually extends to a considerable number. It is perhaps most common amongst the marshes, but appears likewise on the hills, and young sheep are most subject to its visitation.

We are indebted to Messrs. Darby, Evison, and Spilsby for several valuable communications on this disease.

Mr. Darby observes:—'The symptoms in acute cases I have generally found to be a closed eye, disturbed respiration, discharge from the nose, with extreme prostration of strength; pulse from 80 to 100. In this stage you may expect quickly to lose your patient. The *post-mortem* appearances are engorged lungs, and frequently the vessels of the brain are in a stage of turgescence, with more or less disease of the whole of the mucous surfaces. The manyplus is very much distended with food, which appears as if it had been in a press.

'In the chronic stage there is the dull vacant eye—extreme debility—the animal generally leaning against the fence with his back up. Sometimes he feeds moderately, at other times not at all; and so goes on, until ultimately he is worn out with organic disease. The examination after death exhibits sad mischief. The

lungs are often adhering to the sides; and an effusion of serum, in an enormous quantity, into the cavity of the chest; the liver very much diseased; and, in some cases, I have found engorgement of the spleen, with—in both stages of the disease—much frothy mucus in the windpipe.'

Mr. Darby also furnishes us with the following account:—'On the 8th ult. I was called to attend a flock of sheep, consisting of 250 lamb-hogs, which had lost, and was losing, at the rate of four or five sheep daily. The shepherd brought three dead ones from the fold that morning, and on closely examining the flock I found the greater part to be more or less affected with influenza. The eyes were closed, or partially; the head very much affected; a purulent discharge issued from the nostrils, and some hours previous to death a thick ropy discharge took place from the mouth, the stench from which was abominable; a glaring eye, with an inclination to keep forming a circle, was the last symptom; and then death soon closed the scene. On examining those that had died that morning, the following appearances presented themselves: the membrane of the windpipe was of a purple colour, and the tube contained much frothy mucus; the lungs were highly congested, as were the vessels of the brain, and inflammatory patches existed throughout the whole length of the intestinal canal. The symptoms were described next day to Dr. Banks, a physician of this place, and he pronounced them to be the most decided symptoms of influenza he ever heard of in sheep.

'I commenced my *treatment* by giving the whole flock four drams each of Epsom salts, combined with vegetable tonics, and calculating the proper quantity of warm water, we brewed the medicine in the gross, giving each sheep a quarter of a pint of the mixture. I also gave to those that required it small doses of digitalis, opium, tartarised antimony, and vegetable tonics. I am happy in being enabled to add that, after having given this medicine, I never lost a single sheep, and they are at this moment as fine a flock of hogs as any on the walks. I should have said, when I first saw them, that they were on turnips, and having two ounces each of linseed-cake, with barley-chaff. I had them removed from the turnips to old seeds for some days, but they are now on their usual keep. Several of them went blind, but by applying a solution of sulphate of zinc and tincture of opium, they have recovered their sight.'

We have in this account the low fever and the affection of the head and mucous membranes which characterize the influenza of the horse, and which justifies us in giving it the same denomination in the sheep; whilst the same moderate system of treatment was also found successful.

In the following description by Mr. Clayworth, we observe the same character in the principal symptoms, but attended with some modifications, probably arising from the nature of the locality.

Mr. Clayworth, in his communication, observes that he has found the disease most prevalent in the marshes near the sea, where the land is good, but much exposed. It prevails mostly in March and April, and generally attacks young sheep. He then proceeds to give an account of a flock which he attended in 1838. 'On my arrival, on April 19, I found seven or eight dead. They were observed to be ill on the day previous to my seeing them. There were eight more that could not stand, having lost all power of motion. Of the remainder I found some scarcely affected at all, while others were gradually going on in the same way as those that had died.

'The first symptoms exhibited were dulness of countenance, and a disinclination to join the rest of their companions, or look out for food. They soon became more dull; a thin mucous discharge made its appearance from the nose and eyes, the tissues being highly injected; the ears drooped, a grating of the teeth was heard, and a staggering gait evinced in walking.

'The animals were able to walk at a slow pace, but if urged into a quicker one they would fall down on their knees, and then on their sides, throw their heads back, and grate their teeth. At this stage the sheep often became affected with spontaneous diarrhœa. Those that did not purge usually voided much mucus with the dung. After this they would lie still, but continue to grate their teeth, and a rattling noise was heard in the windpipe, accompanied with a frothy discharge from the mouth and nose, and an occasional cough, to which death succeeded in a few hours.

'The *treatment* I pursued with those that could not stand was, first, to place them under a shed, with plenty of dry straw to lie upon; to those affected with diarrhœa astringents were administered, such as catechu, chalk, &c., combining them with an aromatic tonic, and the *spiritus ætheris nitrici*; while to others that were constipated I gave a gentle laxative, following it up with a vegetable tonic. This course of procedure appeared to be attended with benefit; for out of the number, eight that could not stand recovered, and were able to provide for themselves in two or three days. The remainder of the flock were removed into as sheltered a situation as could be found, or sheds were erected for them, with plenty of dry straw to lie upon. A liberal diet of oats and hay was allowed, and their general comfort

attended to as much as possible. To many that gave indications of the approach of an attack of the malady, a laxative and a tonic were combined and given.

'On April 21st the sheep were not only looking better, but had very materially improved. The above-mentioned treatment was continued, with occasional variations, according to the circumstances of each case, and in five or six days they were all out of danger. After this there were not more than two or three sheep out of the flock in which the prostration of strength became so great as to render them unable to stand; and I would add, that I never knew one case recover without the aid of medicine, after the disease had lasted so long as to produce the loss of power.'

We have given these accounts in full, as they are useful, not only as giving clear and satisfactory details of this epidemic, but also as affording a convincing proof of how much can be done in the cure of the diseases of sheep by rational and scientific treatment.

The Epidemic of 1840, since generally termed the *Foot and Mouth Disease.*—In the winter of 1839 and 1840, and throughout the greater portion of the latter, and extending even to the following year, and again making its appearance at the period I am writing, 1843, this country has been visited by an epizootic, to which, for the almost universality of its attack, a parallel can scarcely be found even in the virulent epidemics of former times. Horned cattle and sheep are equally susceptible to its influence; even pigs are not exempt. That it is decidedly contagious no one can doubt, for proofs have been adduced both numerous and positive; and yet its attack is frequently very erratic, attacking perhaps the cows at one period and the sheep at another, and in other places visiting both at the same time. The mouth and the feet are the chief parts locally affected, and in cattle the mouth generally manifested the disease first; but in sheep the feet were earliest and most severely affected, and in the majority of cases the mouth altogether escaped. The constitutional symptoms, too, were less severe in the sheep, but the affection of the feet was generally more virulent and obstinate than with cattle. In the latter an indisposition to feed, from soreness of the mouth, was generally the first symptom perceived; the saliva would drivel from it, and soon large bladders would be observed on and under the tongue, and in other parts of the mouth, which in a few days would burst, when the soreness would become still more severe. These symptoms were also observed in sheep when the mouth was affected, but the feet were, in these animals, usually first

attacked: attention was first directed to a flock by observing some of the sheep lame, and on inspecting them either a sore would be observed between the clees, or the foot would feel very hot. The disease appears to be essentially a fever of a contagious and peculiar nature, affecting and disturbing the whole system, and manifesting itself externally by this affection of the feet and mouth, just as in the human subject small-pox or measles exhibits itself externally by forming eruptions and ulcers on particular parts of the skin. In many instances the disease appears, in sheep, to have been confined to this one local affection of the feet, and sometimes without any treatment the animals have soon got well. Not so, however, in the majority of cases: the sore would spread, the foot feel hot, matter would form beneath it at the back of the foot and between its divisions, and this spreading forwards, the hoofs, in many instances, would slough off, and sometimes fungus, in large quantities, would be thrown out, particularly if the animals were exposed to much moisture. The sheep for a long time would crawl about on their knees, and from inability to walk and the pain combined lose flesh considerably. I have seen in a flock of sheep severely affected some cases in which it was supposed to have extended to the knee-joints, which were in so sad a state of internal inflammation as to threaten loss of the joint, whilst externally they were covered with extensive sores. I am of opinion, however, that this diseased appearance is of a local character, produced by the sheep travelling so much on their knees, or standing so much on one leg, in order to favour the other. In one instance abscesses had formed, and I fear the knife of the shepherd had, in opening them, extended the incision into the joint, and thus added greatly to the inflammation in the joint and the general fever in the system.

Sheep were, generally speaking, much longer in getting well than cattle, which may be attributed to their being more exposed to dirt and moisture, and having from their numbers less personal attention bestowed on them individually. If the animals were attentively examined, symptoms of fever would be discovered, such as a hot mouth and increased circulation, but the affection of the feet was generally the most formidable and most troublesome attendant.

This disease appears to have spread throughout every description of land, and during every variety of weather; in some instances, however, it disappears during a frost, and was generally more prevalent and more severe in wet weather than in dry. In sheep this was more particularly observable, and in them the disease was very considerably protracted by wet lair, and to this, and the

less attention they received, I attribute the fact of their being longer in getting well than cattle.

With regard to the *cause* of this disease, it is, I imagine, beyond the power of man to discover. Some mysterious principle, or some invisible gas escaping from the laboratory of nature, and imbibed by the systems of animals susceptible of its influence, and receiving probably from the emanations of diseased animals a large accession of deleterious and infectious atoms, and thus travelling onwards, and widely extending its ravages, is all that we can offer towards an hypothesis explanatory of the cause of this very serious and troublesome malady. Sheep that travel much, and are driven about from fair to fair, have the disease much more frequently than others that remain stationary; and it is in this manner, in many instances, that it appears to be brought on a farm, or into a district. Whether it is that sheep thus driven about are more likely to meet with the invisible cause of the epidemic, whatever it be, or whether their systems become more excited by travelling, and thus more susceptible to disease;—which of these reasons it is, or whether both are in operation, we cannot tell; the fact, however, is indisputable, that migratory sheep are more frequently affected than others.

There cannot be a doubt as to the infectious nature of this disease; numerous instances have been related which go far towards establishing the fact; but the following experiments, by a German veterinary surgeon, put it altogether beyond doubt. He says:—'My first experiment was on a flock of 900 sheep, 160 of which were already lame. I had those selected in which the horn had not quite come off from the foot, but where it was so loose that a slight pressure of the finger would be enough to separate it. With the matter found in the hoof I inoculated 500 animals on that side of the ear which is most free from wool. In the course of twenty-four hours considerable fever had arisen: in forty-eight hours the inoculated places exhibited symptoms ot intense inflammation; and in seventy-two hours I found in many of them small blisters full of serum. On the sixth day I examined them all separately, and found that nearly every bladder had burst, and that purulent matter, of an unpleasant smell, was escaping from them. During the first ten days after the inoculation, sixty of them became lame, although in each the blister, or pock, had risen on the spot inoculated. That lameness, however, was not very great, and in general lasted only about two days. All the other inoculated animals remained free from the disease, though in some not inoculated it raged as much as before. I can

only explain the circumstance of sixty becoming lame after the inoculation by the supposition that they must previously have been infected. Other experiments have been attended with similar results.'

The *treatment* of this disease consists of both local and constitutional measures, though in slight cases the former may be altogether dispensed with. Take

Sulphate of magnesia	1 ounce.
Nitrate of potash	2 drams.
Powdered ginger	1 dram.
Spirit of nitrous ether	2 drams.

The powders to be gradually mixed with the ether, and a quarter of a pint of warm water then slowly added.

This may be given to each sheep that exhibits appearance of fever. It will of course be the simplest method to prepare this medicine in much larger quantities, but in the same proportion. The sores in the feet may be simply dressed with a solution of sulphate of copper, if confined to the upper parts; but if the lower parts should be affected, and matter should be present under the horn, a sufficient quantity should be removed to give exit to the matter, but the too free and indiscriminate employment of the knife should be avoided, as it is likely to increase the growth of fungus. One of the following applications may then be used:—Take

Oil of tar	½ pint.
Creosote	½ ounce.
Olive oil	1 „

Or,

Barbadoes or Stockholm tar	1 pound.
Melted lard	2 ounces.
Sulphuric acid	1 ounce.

To be carefully mixed.

After one or two applications of the above, the following powder may then be scattered over the sores daily:—

Powdered chalk	4 ounces.
Armenian bole	1 ounce.
Powdered charcoal	1 „
„ alum	½ „
Sulphate of zinc	½ „

Mix.

When fungous flesh is present, a caustic, such as either muriate of antimony or hydrochloric acid (the latter being the strongest),

should be applied with a feather, but should not often be repeated.

An object of equal, if not superior, importance to even medical treatment, is to secure for the sheep a dry surface for their feet. The troublesome and protracted cases which have too frequently occurred, may be attributed in a great measure to the constant dirt and moisture to which the sheep have been exposed; whilst this continues it is vain to expect a cure. The sheep should either be kept in the driest pasture on the farm, or in littered yards or houses, and they should be made to walk over a surface strewed with fresh lime once or twice a day.

After the first symptoms of fever have disappeared, the sheep should be kept pretty well, to counteract the debility and loss of flesh that often supervene. If they are being fattened, plenty of corn and oil-cake should be allowed with the hay and turnips; and if they are ewes in lamb, or with lambs by their side, corn even then, particularly oats, will not be injudicious. This nutritious food should not, however, be given till all symptoms of fever have disappeared.

Epidemic Diseases in Australia.—It will be proper in this place to mention a formidable epizootic which prevailed extensively in New South Wales, in the years 1834 and 1835, and was so fatal in that colony, that some sheep-masters lost half their flocks. An inquiry was instituted by the Governor, under the direction of Mr. Bennett, a surgeon in the colony, and the following is an abstract of their Report, as quoted by Mr. Youatt, in his work on sheep:—

'The character of the runs on which the sheep fed was that of lofty ranges abounding in excellent pasture and good water. They had been placed in this locality five or six years, and had remained perfectly healthy. The winter months had been dry, with severe frosts; but the rain setting in during the latter part of the spring, the epidemic began to appear. The animal separates from his companions, and appears depressed and listless; the eyes are watery, the membrane of the nose red, and the sheep sneezes frequently. A watery discharge, but soon becoming glairy and clammy, is observed from one nostril, and there is a collection of adhesive mucus encrusting the eyelids; the animal ceases to ruminate, and droops his head, but is evidently uneasy, and continually shifting his posture or his place. This first stage lasts from four to twelve hours. The eyes and nose become redder, the discharge increases, it is thicker and of a yellowish hue, and it hardens about the orifices of the nose, and obstructs respiration. The orifice of the nostrils is swelled, the breathing is evidently

hurried, and the animal is in great pain; the head is heavy, and is rested on the hurdles of the fold; and a cough, troublesome and painful, is observed.

'The third and last stage now advances. The membrane of the nose assumes a leaden or dark purple hue; the discharge is lessened, but it is very thick and streaked with blood; the breathing is more laborious, and the cough more painful. The lips, and particularly the upper lip, the nostrils, and sometimes the whole face and head, are swollen; and, presently, a general trembling comes over the animal; he appears stupid; he runs against everything in his way; he kneels down, or falls down; becomes comatose, and, after a few struggles, expires. In some of the sheep death occurred in six hours after the first attack—oftener twelve hours elapsed, and sometimes the animal lingered on to the third day. If he lived beyond that time, he usually recovered. In those that did recover, general debility remained for a long while, and in almost all of them the wool fell off, leaving the poor animals perfectly naked. The surface of the body, after death, appeared to be of a dark purple or livid hue, and the carcass very speedily became putrid.

'*Post-mortem* examination presented, in most cases, inflammation of all the sinuses of the skull, a strong affection of the membranes of the brain, but not the slightest disease of the substance of the brain. The membrane of the nose was highly inflamed and thickened, and a tough viscid matter was effused over it, which could be scraped away with a knife. In many cases the disease was confined to those membranes, except that the heart was gorged with black blood. In other animals the disease was confined to the pulmonary organs; the inflammation extended down the larynx, the trachea, and all the bronchial passages; the membrane was thickened, and the air-tubes obstructed with viscid mucus. The stomachs were usually healthy, and filled with food in a healthy state: the whole of the intestinal canal was perfectly sound, except that the fæces had accumulated in hard lumps, and produced some abrasion of the mucous membrane. The liver was usually free from disease, as were also the kidneys and the bladder.

'The *treatment* was simple, but decisive. The animal was bled almost to fainting, and an ounce of Epsom salts administered, with a dram of nitre, in warm gruel. The infected sheep were separated from the sound ones, without, however, fatiguing or distressing the animals by long harassing journeys or otherwise. If the patient was not relieved in four or six hours, the bleeding was repeated, and the quantity regulated by the effect which it

produced on the pulse. The administration of salts was also persevered in until the bowels were well opened. The chance of success was greater in proportion as these remedial means were early applied. Even in the second stage of the disease they had occasionally good effect, but in the third stage they were of no avail. Relapses on change of weather were frequent, the convalescents being for a long period extremely weak. There did not seem to be any preventive; and those who bled all their sheep, on the appearance of the disease in a few, had reason to repent it, on account of the greater number that were eventually attacked, and in the increased proportion of deaths. It was difficult to ascertain the number of sheep that were effected, and died, or recovered; because this epidemic, like almost every other, was very capricious as to the farms that it attacked, and the proportion of its victims. The greater part of the flocks escaped altogether. Where a flock of sheep, consisting of about 300, was attacked, the average number of patients would be 100, of which about 55 would recover, and 45 be lost. The whole number of deaths was more than 7,000. It was plainly an infectious disease, but only communicable when the animals were brought into actual contact.'

In Sydney, it appears that many sheep die from diseases originating in the astringency of the water, produced by decayed leaves. The following brief account was communicated to the 'Veterinarian' by the late Mr. Cheetham:—

'In consequence of the ruinous effects of a very prevalent complaint among sheep, his Excellency has appointed commissioners to investigate thoroughly the nature of the disease, with a view to its cure, and prevention in future. We have lately had a conversation with an extensive sheep-holder on the subject; and as it is one of a most important nature, I will endeavour to give, for the benefit of the community, the substance of his experience —at least in some diseases which were until then unknown, and whose immediate causes are still little understood.

'The first, then, to which we beg to call the attention of your readers, is the water to which the sheep have general access. The water-holes are usually surrounded with trees, which, during a continued drought, shed their leaves into the water. Now, while any large body of water remains in the holes, the effects arising from the infusion will not be perceptible on the animal; but when, during the excessive heats of summer, the quantity becomes reduced, its powerful astringent effects will be discovered in the disease, and consequent death, of many of the flock. This latter

circumstance more frequently occurs than in cases of scab or rot; because in the latter the nature of the complaint is known immediately, and proper remedies can be applied in the first stage of the disorder; whereas in the former it is unknown until after death (and then only discoverable by a thorough anatomical process), while a remedy or cure is entirely out of the question.

'The only chance which suggests itself to save a flock thus attacked, is instant removal to a situation where water may be obtained without containing that strong principle of tannin which all our trees possess in a greater or less degree.

'There is another disease, not unlike the above, to which sheep are liable, arising from a somewhat similar cause, and to which the same remedy only can be effectually applied. This arises from drinking water impregnated with alum. The gentleman to whom I have formerly alluded informed me that on one occasion a very large proportion of a flock died off—a circumstance for which he could in nowise account. There was no external sign of illness, yet they died. This induced him to subject the carcass of one of them to a regular anatomical process, which pointed out the stomach as the seat of the disease; and, from other appearances, he came to the conclusion that the evil was caused by the water. He accordingly tested the water from holes on the run, and discovered one strongly impregnated with alum. The mystery was elucidated; the flock was removed, and the mortality ceased. We may, however, expect more information upon this subject when a proper investigation shall have taken place.'

The writer does not mention the symptoms of the disease; but, from its cause, I should imagine it must bear some analogy to that termed Pining, described at page 228, which proceeds from the astringency of the food. Epsom salts and other aperients would seem to be proper remedies; but little good can be expected unless the cause also is removed by changing the pasture. In a country like this, where labour is so scarce and dear, the flocks of sheep are of course kept entirely on natural pastures; but if a few succulent roots, such as white turnips, could be cultivated, or the purging flax (*Linum catharticum*), in situations where the disease is apt to prevail, it would materially conduce towards preventing and curing it.

SPECIFIC DISEASES.

Scrofula.—Sheep are liable to a scrofulous disease which is almost uniformly fatal. It is called the *Evil* in some places, and elsewhere receives other denominations. A hard swelling of the

glands under the jaws is first observed; after a time small pustules appear about the head and neck, which break, discharging a white matter, then heal, and are followed by others more numerous. This gradually robs the animal of flesh; and slowly pining away, it becomes at length quite useless, and in this state is destroyed. It seldom attacks a great number at a time, but selects generally a few individuals from a flock.

The writer has succeeded in effecting a cure so far that the tumours disappeared and the animals improved in flesh and health, by administering four or five grains of hydriodate of potash daily in gruel, and rubbing the parts likewise with ointment of iodide of mercury. As soon as the animal is considerably better, it should, however, be sent to the butcher.

Somewhat analogous to this disease is the following account, which appears in vol. x. of the 'Veterinarian.' It is introduced by the editor, who does not mention the country in which the disease appeared and the writer then resided:—

'This spring my South Down sheep looked somewhat ragged in their fleeces, but were in good condition until about six weeks before their lambing, when, notwithstanding their excellent feed, they seemed to lose their flesh, as pregnant animals are apt to do. On the 20th of April I was enabled to turn them on a little grass.

'On the 25th my little flock (our correspondent is a farmer on a very large scale, but this was the first time that he had been enabled to try the South Downs: they had been drawn from the flock of Mr. Ellman, and exported by him) commenced lambing, and every lamb was deformed by an enlargement of the neck. It gasped once or twice, struggled a little, and then died, although perfectly and excellently developed in every other respect. In this way I lost twenty-three lambs, two only living a miserable existence.

'The enlargement varies a little in position up and down the neck, and embraces the thorax more or less closely, and varies in size from that of a walnut to a hen's egg. The lungs had evidently never passed any blood through them.

'I first thought that it was goitre; but it did not correspond with the situation or appearance of that disease. I attributed it to some peculiarity in the water; but, on communication with other breeders, I found that flocks drinking the same water had, in two successive seasons, produced lambs with and without this defect; and I also found that it had appeared where well-water, and also where springs, and brooks, and swampy water had been used; but, with one exception only, I found that, in all cases in which this enlargement of the neck had taken place, the ewes

had been grained (had corn given them), and that, too, pretty highly. What to do with this one exception I do not know. One of my ewes seemed to me to be consumptive, and I kept her in a stable, and fed her with whatever she would eat; oats, oil-cake, hay, turnips, or tea-leaves—no very scientific feeding, you will say. She retained her strength until the lambing time came, and then she brought me a lamb with an enlarged neck. The tutor in my family amused himself with feeding, in a small yard close by mine, half-a-dozen nice ewes. He fed them with poor hay, but the best oats; and they had nothing but snow-water to drink until late in March, when they drank of the same swamp-water as my sheep. All their lambs came perfect.

'I sold six full-bred Merino sheep, and six grade (half-bred) sheep that were fed with a quart of oats per day, and drank at a spring. All their lambs came with enlarged glands.

'I will only remark, that of the lambs that did well the swellings seemed loose, and almost pendulous; yet the breathing was difficult and spasmodic, and there was mucous discharge from the nostrils. One lamb with these swellings died very fat, and in another the swellings have much decreased.

'Within the last twelve months I find that no less than six of my ewes have enlarged necks, which does not seem to inconvenience them in the least; they, however, are not ewes that carry much flesh. The old sheep showing this enlargement have a little puzzled me.'

The *treatment* I should be inclined to adopt in such cases as the above is the exhibition of iodine, in the forms before recommended. The disease may be considered as endemic; and it is to be regretted that the writer makes no observations on the nature of the climate or the soil. The fact of the lambs escaping that were produced by the ewes that had had snow-water (which is exceedingly pure) to drink till near the time of lambing, would induce the belief that the water must, from some mineral taint or other impurity, have been an active cause in producing the disease. In such case, where an endemical disease makes its appearance, a discovery of the cause is better than that of the cure; and, in the instance in question, no pains should have been spared in eliciting it. Numerous experiments should be instituted, by keeping various ewes on different food and water, and by such means the real cause of the mischief would have been brought to light.

Dropsy.—Various parts of the body may become affected with anasarcous or dropsical swellings, although by no means so frequently as in the horse. The following brief account of such

disease is communicated by Mr. J. Tombs, in vol. xiv. of the 'Veterinarian:'—

'There has been a disease very prevalent among sheep in this county (Worcestershire): it made its appearance about a week after they were shorn. A swelling came on near the udder, and extended along on both sides of the abdomen to the anterior extremities. After it had existed for some time, a swelling on the inside of the thighs came on. The pulse was quick and feeble; the eyes had a peculiarly watery appearance; the animals were very soon emaciated. The shepherds very improperly called it murrain, as it was to all intents and purposes *anasarca*, the swellings, when punctured, discharging a watery fluid. The causes of the disease were—cold and wet weather when shorn, and eating wet grass. Many shepherds, thinking it was murrain, dressed the sheep with liquid caustics, which killed them outright. The cases that came under my notice yielded to repelling lotions, and the exhibition of diuretics and vegetable tonics.'

This disease, or one very similar to it, prevails in some of the midland counties, and is denominated *Black-leg*. It is best treated by mild aperients, and diuretics combined with tonics.

In all dropsical affections it will be prudent to change the food from wet to dry, giving good hay cut into chaff, with a little corn and oatmeal gruel. When water collects within the cavity of the abdomen, as it sometimes does, and generally in old sheep, it is usually preceded by some degree of inflammation of the eritoneum, the membrane by which the water is secreted.

LOCAL DISEASES.

Injuries of the Feet.—We have noticed the peculiar structure of the feet in sheep in a previous part of the work, p. 95, and we have mentioned that the principal part of the weight is supported by the heel or back part of the foot. The front part is, from its pointed nature, well adapted to preserve the foot-hold and prevent slipping, particularly in ascending rocky declivities; and in such situations, and particularly if the animal has to travel, the wear of the horn at the toe is equal to its growth. But in wet pastures, or on soft soil, the growth of the toe is much greater than the wear, and consequently this part often grows extremely long and irregular, so that it separates from the quick, and dirt sinuates, and lameness and a troublesome wound are the consequences, sometimes leading to foot-rot. This might be prevented by cutting off the superfluous horn with the knife.

The foot of the sheep often becomes sore from travelling, particularly on sandy roads. In this case it is the heels and the skin between them that suffer; but timely rest will set the matter right, and a little oil of tar may be applied to the wound.

Sometimes the biflex canal becomes the seat of disease and the cause of lameness; sand may penetrate, or the part may be chafed by much walking in the dirt, and inflammation and ulceration are the consequence. The part should be cleaned and dressed with a little tincture of myrrh, or the astringent powder recommended at p. 293 for the epidemic. If proud flesh forms, it should be kept down with the muriate of antimony.

These various injuries often prove very troublesome from the circumstance of the sheep being exposed to dirt and moisture and the vicissitudes of the weather, and sometimes prove the forerunner of a still more troublesome malady.

The Foot-rot.—This disease is a sadly troublesome affair both to the sheep-owner and the shepherd; and though seldom fatal, yet often, by the irritation and lameness it produces, robs the animal of its flesh, to the great injury of the owner. It consists of inflammation and suppuration, and often ulceration of the sensible and secreting parts of the foot, and occurs either during or immediately after a long continuance of wet weather, and is most prevalent on land retentive of wet. There is much difference of opinion as to its being contagious or not. Mr. Read, in an excellent essay on the subject, in vol. xiii. of the 'Veterinarian,' inclines to the opinion that it is not so, but believes that the sheep are all infected from the same cause; but we will let him speak for himself presently. Many writers consider it infectious, and some carry this opinion so far as to believe that the infection may remain in the ground for years; this, however, is absurd. A shepherd, in a communication in vol. xii. of the 'Veterinarian,' after stating his belief that it is decidedly infectious, mentions an instance of a large flock, half-bred, between the Leicester and the Down, though occupying a sound pasture, yet becoming affected in consequence of a neighbouring plantation being thrown open, which plantation was almost constantly in a wet state: the effect produced was to give the foot-rot to every sheep or lamb that entered it, though after a time the sheep that were used to it enjoyed a comparative immunity, although if any strangers were turned in, they were sure to become affected.

We are inclined to the opinion that the disease is produced by the continual immersion of the feet in a wet or damp soil, by which the horn is softened and weakened, and no longer capable of protecting the vascular parts beneath. It is probably assisted

by decaying vegetation, and the diseased matter from the feet of the affected sheep probably assists in producing the disease when aided by the agency of moisture. But as for the disease being always or even generally produced by contagion, such opinion is undoubtedly erroneous. Whether this theory be correct or otherwise, there cannot be a doubt of the close connection which moisture has with the disease, and the disposition which land retentive of wet has to produce it. We are aware that many whose opinions are deserving of great weight express a positive opinion against the foot-rot being contagious, and this opinion is grounded chiefly on the fact which has come before their notice, that diseased sheep have failed to produce the foot-rot in sound animals on dry lands. This, however, is not sufficient to establish its non-contagiousness; for when the horn is dry and strong, and free from cracks and fissures, and the skin above also sound and properly lubricated with the unctuous secretion which is here particularly supplied, there is no disposition to absorb foreign matters, but, on the contrary, a power of resisting their influence, and thus we cannot be surprised that the foot-rot matter has no effect under such circumstances. When, however, the oily secretion is washed off, the skin in an irritable and probably sore state from the friction of the wet and dirt between the clees, the horn long at the toe and ragged underneath, and particularly the upper or coronary portion which unites with the skin, and consequently is very thin—when this part is blanched, weakened, and probably in some degree separated from the skin above, we cannot be surprised that such a state of the parts must greatly expose them to the action of any infectious matter from without. Even if we regard the disease as contagious, we do not imagine that it is propagated so much by this means as by the various causes that we have just mentioned, and more particularly by the reaction which follows on a change of weather, or even without it.

The progressive *symptoms* developed by this disease are so well described by Mr. W. Hogg in a prize essay communicated to the Highland Society, that we cannot do better than give it a place here. He observes:—'The first indication of the foot-rot is a slight halt in the animal. It gradually increases, and in two or three days the animal assumes a lank appearance, lags behind the rest, lies much, and, when roused, appears anxious, and confused at finding itself alone. It becomes more and more lame. Frequently the hoof is swelled; and in the course of five, eight, or ten days, the insensible laminæ which lines it is dissolved, and the hoof hangs loose round the exterior of the foot, entirely separated from it, except at the upper edge. The disease also eats through

the hoof, generally at its lower edges, after which the horny part comes away in fragments. The insensible part of the sole also peels off, leaving the incrustation which invests the bone quite bare. The animal is then obliged to gather its food on its knees. It remains in a single spot all day, and becomes very lean; and, if the summer be soft and sultry, is unable to preserve itself from the intrusion of the flesh-fly, so that at length maggots swarm over its whole body. If it lingers on till about Martinmas, when long exposure to the air and sharp nights of frost kills the contagion, a new hoof grows from its upper edge, and the foot is again sheathed in a horny case; but if winter sets in with severity, the animal, already disfigured by pain and disease, generally falls a victim. Such are the consequences of foot-rot when the disease is not interrupted in its progress.

'On examining the foot, in the first stage of the disease, the coronary edge, though no external injury can be traced, is sometimes found a little swollen and inflamed; at other times the hoof is eroded; but whether it be shattered or entire, an intense heat is always perceptible in the foot, with a strong pulsation in the arteries, where they are inserted into the coronary edges of the hoof; and, however sound the hoof may appear externally, the connexion between it and the interior of the foot is always dissolved, though the separation is not evident till the hoof is pared away. A peculiar smell is perceptible, especially in the advanced stages, or when the ulcerous part is newly opened; yet, even in the worst cases, a large quantity of ichor is never discharged, there being little more than will wet the finger, and that only when pressed out.'

The late Mr. Read, V. S., of Crediton, Devon, has written in the 'Veterinarian' an excellent essay on this disease; and as it is at once both practical and scientific, and accords for the most part with our own views—and we have witnessed the ravages of the disease to a great extent—we prefer quoting largely from it. Mr. Read observes that the disease is of extensive prevalence in his neighbourhood, 'and on some farms scarcely, if ever, absent, particularly if they consist of rich meadow, old pasturage park lands, or meadows, situated near towns, so as to receive the contents of drains and cesspools. Low situations, conjoined with moisture, are the fruitful and primary causes of foot-rot. Sheep in these situations have their hoofs and the integument above to which they are united, and the highly elastic tissue situated between the claws, constantly in a wet and humid state. Go into any of these pastures after sheep have been placed there for only a short period, and look at their feet—will there not be an in-

creased growth of hoof? will not the skin round the coronet, and the highly sensitive membranous tissue between the claws, be blanched? will not the vascularity of the parts be weakened from its circulation being enfeebled? Now this is all produced by wet. In a few days, perhaps, we have a change of temperature; evaporation is produced from the surface of the land, and from animal bodies as well, and the ground becomes drier. A re-action takes place, the circulation is quickened; the hoof swells, or rather is pushed from the parts beneath; the skin between the claws inflames; the heels bulge; the coronet enlarges; abscesses form; matter penetrates between the horn and the substance beneath, and disunites the sensitive from the horny laminæ; and in the worst forms of the disease the hoof falls off. The joints, tendons, and ligaments are soon implicated. Sometimes, from the overshooting of the toe of the hoof, it turns back or upwards, and breaks the horny sole from the crust; gravel then gets in; inflammation is set up; a separation of the foot from its horny covering is produced; and from every part of the foot thus denuded fungus quickly sprouts. The true foot-rot does not, as is generally thought, so often begin from below as from above.

'Hundreds of sheep on sharp sandy farms wear away their hoofs and soles, and expose the sensitive parts. A little heat and tenderness ensue, and matter forms, which is soon replaced by fungus. This might be got rid of in a short time. It is only a spurious kind of rot, and is again produced by the injudicious paring of the horny parts by the farmers and shepherds.

'If a little gravel happens to have insinuated itself between the junction of the crust and sole, the knife cuts away without any ceremony too much of the crust, exposing the laminæ, and the sole is so thinned as to afford no protection in walking. The animal limps at every step from the want of the horny crust; whereas, by only properly paring the foot, all might have been prevented.

'It is now-a-days too much the fashion for the farmer or shepherd to have his sheep-foot knife always in his pocket, and every poor animal that happens to halt is caught, and but too often unmercifully pared. I have myself been an eye-witness to this. I have reasoned on its impropriety. The knife has been spared, and lameness has diminished. These two last causes are mechanical productions of the disease. Yet, on the other hand, if the foot is improperly managed, and a fair vent not given for the escape of the matter, it rises upwards and breaks out at the coronet, and makes the cure more tedious.

'Sometimes one foot, either the fore or hinder, is affected, at other times both fore feet; now and then all four; sometimes only a single claw on one foot, and both on another. Such are the symptoms which I have been accustomed to observe during fifteen years' practice among these useful animals. As to the question of its contagiousness, I have never been able to make up my mind decidedly on this point, although the strong leaning of my opinion is against its contagiousness. For the last three or four years I have made every inquiry of men accustomed to sheep. Some say, on my asking their opinion, that it is as infectious as the plague; for if they put a lot of sound ones with some that were lame, they all become so. But I have then said, "Perhaps the sheep with whom yours were put were in a soil favourable to the production of the foot-rot, and yours were taken from a healthy soil." Such was generally the case, and such is the proof which farmers and others pretend to give us of its infectious nature. Little do they imagine what is the operating cause on a soil disposed to it. That which gives it to one will give it to a hundred, if there is a predisposition to take it on.

'Again, we hear of farmers that never had it on their estates, the farms being on healthy sites; but happening to take for a season, or buy at an auction, a ram that had the disease, and put him with the ewes, in from four to six weeks nearly the whole flock had been lamed. Scores of histories of this kind had been told me by different people; but, from what I could gather, they were solitary cases, and confined to the experience of the individual narrator. It might have been a wet season; for, during a very wet or rainy summer (which has this year been the case) many farms that were free from, and others that rarely had it, have this season been pestered with it. Such a season might have occurred when conclusions were made to establish its contagiousness.

'My opinion is, that you may put lame sheep with sound ones on a healthy farm, and they will soon get well, and the others will not become infected. As a proof of this, I will relate the experience of a near relative of mine who has a very healthy sheep estate, but who also rents an extraordinary rich flat piece of meadow-land watered by the town sewers. His sheep are put there occasionally; but before a fortnight has expired they are nearly all lame. He drives them home again, and in a very short time they are all sound, and not one of the others infected; but if the lame sheep had been driven back to a farm disposed to the foot-rot (although none lame thereon at the time), it would have

been ascribed to infection, had they also become lame after some lapse of time, instead of the soil, which is the grand operating cause, in conjunction with moisture.

'If this disease is infectious, how is it induced? Many experiments have been tried by the French and others, by a direct application of the matter to the feet of sheep, on abraded and non-abraded surfaces; but the results have not been satisfactory. Now, if a direct manual application of the discharge to the feet of sheep scarcely, if ever, produces the malady, how can sheep acquire the foot-rot from one another by walking or treading about while feeding, when it is with so much difficulty produced by the actual contact of matter discharged from feet having the disease? The discharge issuing from feet in any stage of the disorder is not in a very considerable quantity, and must be lost on the land on which they are roving about. Neither are they infected while being folded so close in contact as to render it almost impossible that they should avoid inoculating themselves.

'Shepherds and sheep-breeders, however, cannot be dissuaded that if a piece of land or an enclosure, which gave their flock the foot-rot seven years since, should at the end of that period have some sheep turned upon it; and again, although none had been pastured there during these years, contract the lameness, they cannot, I say, be dissuaded from the belief that it must have remained in the ground with all its virulence the whole time, not thinking that the same soil which produced it seven years ago is capable of producing, for ages to come, under favourable circumstances, the same disease.

'There are, however, many stubborn facts recorded as to its infectious nature. Should these happen to be true, can there be given off from the feet of sheep labouring under the disease an animal effluvium, which, on a soil predisposed to it, is still rendered more contagious by uniting with any exhalation from the earth? Then, on the other hand, sheep with the foot-rot, put on a sound farm, oftentimes cure themselves, and do not infect the others. Such may be the case. as exhalations vary on different soils in their constituent parts as the land does in quality. Now, if empoisoned effluvia from the feet, or any malaria from the soil, uniting, become the cause, the effect must be produced on the local part by means of respiration whilst depasturing. We all know that there are many local diseases produced through atmospheric agency, and of a specific nature, capable of being again produced by inoculation.'

With reference to *treatment*, Mr. Read observes:—'When a sheep halts, let your attendant cast him. Then, if the hoof is too

long, pare it on a level with the sole; shorten the toe; and be particular in examining the foot between the claws. If it is swollen, looks red, or has any discharge of bloody serum oozing from any fissure or fissures, let the solution of the bichloride of mercury or hydrochloric acid be well applied to the part by means of a little tow twisted, or a small flat piece of whalebone, and in this stage of the complaint one dressing is usually sufficient. There is nothing so much desired by the farmer as an application which will at once put a stop to this complaint. The trouble it would save is incalculable when we consider the time it takes to dress the feet every day of from thirty to fifty or one hundred sheep. If abscesses have formed around the coronet and burst, they usually have two or three fistulous openings, which, with your silver probe, you will soon discover. Arm the eye of the probe with a little tow dipped in the solution, and draw it through the sinus or sinuses. If they extend into the joint, the same thing must be done. Twice is most commonly sufficient to apply the solution in these cases; and oftentimes, when you attempt to pass the probe the second time, you will not be able, from its being filled with coagulated lymph. If any of the discharge is between the crust, pare the sole, and with a feather or syringe apply it to the part. Fungus is sure to sprout from any part where the sole or crust is lost, and rapidly will it sprout. Agriculturists and shepherds are at a loss in curing these morbid growths, as they resist nearly all the caustic applications in use, both empirical and those contained in the Materia Medica. Butyr of antimony, quicksilver and aquafortis, and numerous other applications, are of no avail, especially if the disease is of long standing. There is but one quick and effectual remedy, that is the hot iron, which will do more good in five minutes than all the caustics in our pharmacy.

'About four months ago I was called in to look at two very valuable rams, that had been lame for four months with a fungous sole, belonging to a celebrated breeder, who had tried all his usual remedies to no purpose. I applied the hot iron with a keen edge, so as to cut off the fungus. All fungus that sprouts from a denuded sole when of long standing becomes hard and contracted at its base, which a hot iron will soon remove, and the lameness also in a few days, as it did in the case just recited. The fungus that grows from any part of the foot, from between the claws, from the laminæ, and from the junction of the crust at the heel, may all be removed in the like manner by a keen hot iron.'

There are many specifics which are recommended for this disease, and all with the boast of being entirely successful. Some

rely with confidence on the muriate of antimony, which is a very good application; others on a mixture which is supposed to acquire much of its virtue from the presence of gunpowder. Mr. Hogg, whom we have before quoted, advises the following mixture, having found it very successful, first removing the horn from the part having matter underneath:—

Turpentine	2 ounces.
Sulphuric acid	2 drams.

to be well mixed before it is used, and then to be applied freely to the diseased part.

An ounce of olive-oil and double the quantity of the sulphuric acid would, I take it, be an improvement. The acid must be mixed carefully with the turpentine, as considerable inflammation immediately takes place. In our own experience we have used all the powerful acids with success; and it is, I imagine, of but little consequence which caustic is employed, provided it be of sufficient strength. The beneficial agency of a caustic may be thus explained: it first destroys the parts to which it is applied, thus arresting the progress of the disease by substituting a more destructive though more limited action for a milder but more progressive one. The caustic not only burns the diseased part, but that in contact with it, or, as Shakespeare says, 'One fire puts out another burning,' on the same principle as we pull down a single house to preserve a whole street from the flames. The diseased action being thus arrested, an eschar is formed which protects the parts beneath, whilst a new and healthy action on a level surface is set up. The treatment pursued by Mr. Read is as good as can be employed; and in cases progressing favourably, but still possessing sores, we have used with much benefit the astringent powder recommended in the chapter on the Epidemic. It will also greatly assist the cure if the diseased sheep are put in a shed with a clean floor, on which some quicklime is spread every day.

Professor Brown has an interesting article on the foot-rot in the 'Journal of the B.W.E.S.', 1864, illustrated by some woodcuts, showing the peculiar structure of the foot in health and under disease. He expressed a decided opinion that the disease is not contagious, but is due entirely to the wet soil. He advises the following composition when a caustic is required:—

Two drams of mercury to be dissolved in two ounces of nitric acid, then add an ounce each of hydrochloric and acetic acid, and dilute with four to twelve parts of water, according to the strength required.

In certain stages creosote and carbolic acid, as powerful antiseptics, will be found very useful.

Diseases of the Eye.—Sheep are subject to inflammation of the eye far more frequently than is generally imagined, and the number of instances of total or partial blindness of one or both eyes that are to be met with in the slaughter-house are very numerous. It is unnecessary to make those distinctions which, though they probably exist in the sheep as well as other animals, are of little practical importance; but there are two varieties of inflammation which it will be proper to mention. One is of a superficial description, and is produced either by a cold or external injury, and is attended with dulness and weakness of the eyes, and a discharge of tears at first, and afterwards of mucus from the corners of the eyes. One effect of this attack, which not unfrequently occurs, is adhesion of the lids to the eye at first, with mucus, and afterwards with lymph, which if neglected produces blindness by covering the sight. This effect is more likely to be produced if the lids participate in the inflammation, and more particularly if there is any scab about the animal at the same time, so as to cause rubbing. It is necessary in such case to separate the lid from the eye by means of the handle of a spoon, or a bit of smooth wood, and to apply some cooling ointment or oil to the part, to prevent adhesion again.

The more severe kind of *ophthalmia* frequently occurs without apparent cause, and the sheep is said to be lark-spurred, from the supposition that the injury has been produced by the spurs of a lark. The idea, of course, is ridiculous. The disease sometimes quickly disorganises the eye, and at other times is much slower in its progress. It may terminate in blindness either by causing opacity of the cornea, the humours of the eye to be cloudy, or the crystalline lens opaque, which is, in fact, a cataract; or there may be general disorganisation throughout the whole of the eye.

The *treatment* of these cases must consist in bleeding from the vein under the eye, lancing the eyelids, and fomenting the eye with warm water; and if the animal is of sufficient value—such, for instance, as a choice ram or ewe—following up the treatment by a dose of salts and the frequent application to the eye of a lotion consisting of an ounce of tincture of opium in a pint of cold water.

Besides these diseases, the eye is sometimes torn and lacerated from injuries received from fighting with other sheep; and when the substance of the eye is broken through, blindness always follows. When less severe, the treatment before advised will be found effectual.

Gutta-serena, or *amaurosis*, or paralysis of the optic nerve, sometimes occurs from injury of the brain, and it not unfrequently accompanies giddiness. It is generally incurable.

Diseases of the Mouth.—Sheep are liable to several diseases of the mouth, the most frequent of which is *Blain* or *Gloss-Anthrax*. In this the tongue, or rather its connections, are mostly affected: a number of vescicles or bladders appear on its side, attended with inability to feed, and a discharge of saliva from the mouth, which sometimes becomes bloody and offensive. These bladders burst, and leave behind large sores, which sometimes become troublesome ulcers; and these symptoms are occasionally attended with swellings of the head and throat. There is little doubt but that the disease is infectious, whether it appears as an epidemic or not, and therefore the affected sheep should be immediately separated from the rest of the flock. The vesicles should be freely lanced, and, after being well cleaned with warm water, may be washed with half an ounce of alum dissolved in water; but if the discharge is anyways offensive, the mouth should be washed with a lotion composed of one dram of chloride of lime dissolved in a pint of warm water. The sheep should be drenched with gruel, in which should be mixed, if the animal is weak, a dram of ginger and two of gentian.

Aphthæ, or Thrush, is another disease of the mouth with which sheep are affected. It sometimes resembles that last described, but is less severe. It is attended with vesicles, but of a slighter description, and the sheep is often unable to feed.

The following cases are related by Mr. Rawlins, of Bristol, in vol. x. of the 'Veterinarian.' He says: 'In the month of May, 1836, I was requested to examine the flock of Mr. Charles Marshal, Snowshill, near Broadway, Worcestershire, who had lost several ewes and lambs previous to my seeing them. I found seventy lambs in a most emaciated state, scarcely able to move, their mouths presenting a mass of disease, being one complete ulcer. On examination, I found a large fungus issuing from and around the lower gum, enveloping the teeth, and protruding over the lip to a very considerable extent. There were about thirty lambs more or less affected. The disease clearly originated in the lower gum, and when it was matured to any extent the ewes refused to allow the lamb to suck, and it gradually pined away. At this stage of the disease, the lamb communicates it to the ewe's udder. As soon as she is affected, she begins to lose flesh most rapidly; the udder becomes tumefied. In some of the extreme cases the udder suppurated, and parts of it, with one or both teats, sloughed; and the ewe was rendered useless for a stock ewe.

'My first object was to get the flock separated—those severely affected, both ewes and lambs, from those less so; and to keep the sound ones in a distant field, the disease being contagious. By carefully attending to this plan and examining the flock, and removing those that became affected, and using the following detergent dressing, I succeeded in curing the whole. Take of

Simple oxymel	½ lb.
Burnt alum	6 ounces.
Sulphate of copper	2 drams.

Mix, and apply it every morning to the affected part.

'Mr. Hyatt, at the adjoining farm, had his flock also affected, but by using the same means his sheep soon got well.'

The above treatment is as good as can be employed.

INJURIES AND OPERATIONS.

Sheep are not very liable to external injuries; but occasionally we find them either in the form of *Wounds, Bruises, Abscess, Strains, and Fractures.*

Wounds are of various kinds, either simply incised, lacerated, superficial, or deep-seated.

A single incised wound should, if possible, be united by the first intention; the edges of the skin should be brought together, and joined by means of stitches, over which a bandage may be placed, and by this means a cure is frequently effected in a short time. If the injury is considerable, metallic wire will be the best material for these stitches.

If the wound is lacerated and irregular, and extending amongst the flesh or muscles, this plan cannot be adopted, and should not be attempted. The parts should be fomented and kept clean, and a mild stimulant, such as the tincture of myrrh, may be applied, and the astringent powder, recommended at page 293, may then be scattered over the wound every day. Flesh generally heals very rapidly, but skin is far more tedious, as it grows only from the edges of the old skin. Thus the time which an extensive wound may take in getting well may be estimated by the quantity of skin to be supplied. In horses new skin is generally weaker than the old, and does not carry any hair, the bulbs of the hairs having been lost with the old, and not replaced with the new skin; but in sheep there is very frequently a horny excrescence that grows on the surface of the new skin, in the place of the wool. When the granulations are too luxuriant, rising above the level of the neighbouring skin, as will generally be the case with

extensive wounds, they should, be touched by means of a feather, with a little muriate of antimony or other caustic, every day till sufficiently reduced.

Bruises are not very common with sheep, the wool forming generally a secure protection from such injury. When, however, they occur, hot fomentations are the best means of reducing the attending inflammation.

Abscess, which is a collection of pus or matter under the skin, may be produced by a bruise, or by some constitutional cause. Whilst collecting, the surface of the skin is usually very tender, and sometimes there is also much constitutional irritation present. A collection of matter may be known by the heat, swelling, and pain of the part. On pressing it, the contained fluid is felt to fluctuate; and the pressure being removed, the part immediately assumes its former shape, whilst a watery or dropsical swelling, on being pressed, leaves for some time the marks of the fingers. After some time the abscess points; that is, the matter can be more distinctly felt at one particular part, at which, if permitted, the abscess would soon burst. This however, should be avoided by opening the abscess at the lowest part, or that which would admit most readily of its discharging itself. The opening should be large, and no dressing will be required except the continuance of the fomentation, which should previously be used. It should be observed, that if the abscess is languid and slow in forming, a stimulant, such as hartshorn and oil, rubbed in occasionally, will be useful.

Strains are very rare with sheep, locomotion in these animals being slow and careful. When, however, they do occur, the fetlock joint is the part most frequently so injured. The *treatment* should be rest, fomentations, and poultices; and if any swelling afterwards continues, a strong stimulant or mild blister may be rubbed in.

Fractures are sometimes the consequence of falls; the bones below the knee are those most frequently so injured. If the skin is cut through by the broken bones, it is called a *compound* fracture; whilst, if the skin is not thus penetrated, the injury is denominated a *simple* fracture. In the former case, if the carcass is of any value, the wisest plan will generally be to destroy the animal, unless, indeed, it should be a ram of value.

The *treatment* of a fracture will be, in the first place, to reduce it; that is, to restore the bones to their proper situation, which should be effected with much care. The wool having been cut from the limb, some slips of coarse brown paper, smeared on one side with gum or paste, should be wound round the part a great

many times, and over this some fine tow should be placed in the greatest abundance where the limb is smallest, so as to render it of a uniform size, by which means the bandages will be prevented from shifting. Two bandages of linen or cotton, about three or four inches wide, and four feet long, should then be carefully put on, a little paste or gum being likewise smeared on one side. This mode of treatment will be better than using wooden splints, and less likely to injure the skin. The animal should be kept perfectly quiet, and the bandages should remain on for a month.

Castration.—The earlier this operation is performed, the less likely is it to be followed by injurious effects. A favourable day should be selected, dry, but neither hot nor cold; and if the flock is considerable, it will be better to operate upon the lambs at different periods—by which they can all be operated on at pretty nearly the same age—than to wait and perform the whole at the same time: a fortnight is a very good age. It will also save trouble, and be quite as well, to dock them at the same time. There are different methods of performing the operation; but the following, which we have generally practised, is as expeditious, convenient, little painful, and satisfactory as any:—

The operator sits astride on a long stool, with one of the lamb's hind legs under each thigh, the fore legs and head being held by an assistant. With the finger and thumb of the left hand, he draws up the lower part of the scrotum or bag, and cuts off a portion of the skin with a sharp scalpel or knife. He then grasps the upper part of the scrotum, which forces the testicles forwards, and with one incision separates the septum or membrane which divides the testicles, sufficiently to cause them both to escape from the bag. He then places the iron clams on the cords above the testicles, and with a hot iron divides the cords, and the operation is completed. By removing a portion of the skin, though the wound is rather longer healing, there is less likelihood of matter collecting within the bag. A little lard may be smeared on the parts afterwards, to keep off the flies, &c. Before the operation is performed the bag should be examined, in order to find whether any rupture exists; if so, some of the intestines will have escaped into the scrotum. In such case, the operation must be performed in a more careful and elaborate manner. Four small slips of wood, about four inches in length, must first be provided. Two sticks of elder cut in half will be most suitable; and it will be better if the pith is removed, and the vacancy filled with some caustic. One end of each pair must be fastened together with waxed thread. The intestines should be gently forced up into the abdomen, at any rate as high as possible. An incision

should then be carefully made over each testicle, and through the skin alone: the testicle, with its coverings, should then be pressed through the opening in the skin, which being held back, the elder-sticks should be placed on the cord above the testicle; and the ends having been previously united on one side, the other ends should be brought together, and firmly tied by an assistant with waxed thread. The other testicle may then be operated on in a similar manner. Care must be taken that neither the skin nor any portion of the intestine be included in the wooden clams, and they must be pressed together as closely as possible.

In the course of three or four days the lamb should be examined; and if the testicle has fallen off, or can be removed by the hand, the thread may be cut and the clams removed.

In castrating full-grown rams, it is better to take out each testicle separately, through an incision made into each compartment of the scrotum, and the same method may be adopted as is practised with the horse.

Docking.—This simple operation is performed on most lambs at an early age, generally, and very properly, at the period of castration. In the Dorset and Somerset horned sheep, and a few others, it is, however, customary to leave the tails; but if diarrhœa should attack the lamb, as it is likely to do in some degree, the long tails harbour filth, and sometimes cause sores, on which the fly will deposit its eggs.

The best method of performing the operation is to place the tail on a block of wood, and excise it with a sharp iron, red hot, about four inches from the root. It may, however, be cut off without any bad effect.

A LIST OF MEDICINES

EMPLOYED IN THE TREATMENT OF THE DISEASES OF SHEEP.

Aloes, though a valuable purgative in the horse, is rarely, if ever, employed in the sheep internally, being uncertain and attended with danger; as a tincture, however, it becomes a useful stimulant to wounds.

Alum. An astringent. Dose, half a dram with gruel; but it is inferior to other astringents. As an external application it is useful as a wash or lotion applied to the mouth in several of its diseases, and also mixed with chalk it makes a good external application to sores.

Antimony, Butyr or Chloride of. An excellent caustic for foot-rot and other diseases. It may be applied with a feather.

Areca Nut. Recommended by Professor Cobbold as a vermifuge. Dose, one to two drams, combined with a similar quantity of male fern, powdered.

Arsenic is sometimes used as an infusion for the purpose of dipping sheep, to destroy ticks and other insects. It should be employed with caution, and the vessels in which it is used carefully cleansed afterwards. Too much caution can scarcely be used in the application of arsenic or corrosive sublimate to the skin. A gentleman in Dorsetshire having some fine sheep preparing for an approaching show, had then sheared and then anointed with oil, and afterwards Courtney's fly-powder rubbed in, the consequence of which was that a dozen died very shortly afterwards. The previous application of the oil no doubt assisted the absorption of the poison, and the danger is therefore much greater than if used as a powder, or even as a lotion.

The following prescriptions for sheep-washes are given in 'Morton's Manual of Pharmacy':—

Arsenic powder	6 ounces.
Carbonate of potassa . . .	5 „
Water	14 gals.

Boil for half an hour.

Also—Arsenic powder	6 ounces.
Soft soap	6 „
Carbonte of potassa	6 „
Sulphur	4 „
Hellebore root	2 „
Water	14 gals.

Boil for half an hour in a portion of the water, then add the remainder and strain. To be used with care in cases of scab.

Camphor is both a narcotic, sedative, and anti-spasmodic. Dose, one scruple to a dram. It is also used with oil or spirits of wine as an external stimulant.

Cantharides (Spanish Flies). The principal ingredient in blisters, but otherwise rarely employed in the sheep.

Caraway-seeds. Stomachic. Dose, two to four drams.

Carbolic Acid. This is found very useful as a topical application in foot-rot, and in the foot-and-mouth disease. Messrs. McDougall make an excellent disenfectant, in which carbolic acid is combined with sulphurous acid, magnesia, and lime, and also with soluble phosphate.

Catechu. A useful astringent, and as such employed with opium and chalk in diarrhœa. Dose, half a dram to a dram.

Chalk, Prepared. An antacid and mild astringent, excellent in diarrhœa. Dose, half an ounce to an ounce. Also a useful external application to wounds and sores.

Colchicum (Meadow Saffron) sometimes proves poisonous to cattle and sheep when partaken too largely. A useful medicine in rheumatic affections, and those of the eye. Dose, for a sheep, one scruple of the dry powdered root, or the seed.

Copper, Sulphate of (Blue Vitriol). Externally a mild caustic; internally a tonic. Dose, half a dram.

Corrosive Sublimate (Bichloride of Mercury). A strong caustic and poison, sometimes employed for the scab, and to destroy vermin. It requires much caution.

Creasote. A very useful application to foul ulcers and to foot-rot. Creasote and oil of turpentine, of each two ounces, olive-oil four ounces, will make a good liniment, or an ointment may be made by combining two parts of creasote with eight parts of lard.

Croton Seeds or Oil. A very powerful purgative, rarely used in sheep, but useful in obstinate constipation. Dose, five to fifteen drops of the oil.

Digitalis (Fox-glove). A sedative, lowering and diminishing the action of the heart. Dose, one scruple.

Epsom Salts (Sulphate of Magnesia). An excellent purgative in doses of from one to two ounces, or more, dissolved in warm water or gruel.

Fern. The male fern is a very good vermifuge, and may be given in a powdered state. Dose, for a sheep, one to two drams. This fern no doubt tends to keep away worms from cattle turned into forests.

Gentian. A useful vegetable tonic. Dose, from one to three drams.

Ginger. A valuable cordial and stomachic. Dose, from half a dram to two drams. It is very commonly given with aperient medicine, which it prevents griping.

Hartshorn, Spirit of. A stimulant and anti-spasmodic useful in hoove. Dose, two drams in six ounces of warm gruel or water.

Iodine. A powerful stimulant to the absorbent vessels, whether administered externally by friction or internally. It has peculiar influence over glandular swellings, and is generally administered in the form of Iodide of Potassium internally in doses from four to six grains, or in the form of

Iodide of Mercury, with eight parts of lard as an external application. For enlargement of the udder or other glands the ointment of Iodide of Potassium will often be found useful.

Laudanum. See *Opium.*

Lead, Acetate or *Sugar of Lead,* or in the form of Goulard's extract, is a common ingredient in cooling lotions.

Lead, White, is a useful application for the prevention of the fly.

Lime, Chloride of. A valuable antiseptic, and an excellent application to foul and offensive wounds and ulcers. Also useful as a means of preventing infection.

Linseed Oil. A safe and useful purgative, though less suitable than the sulphate of magnesia. Dose, two ounces.

Locust Beans or Sugar Pods.—Imported in cargoes from Portugal and Africa. It is used as sheep food, and is much relished, and when ground forms the basis of the spiced food, which is sold at a high price. It contains 50 per cent. of sugar.

Magnesia, Sulphate of. See *Epsom Salts.*

Mercurial Ointment is sometimes employed for the scab, but it should be diluted with four or five times the quantity of lard and of the mixture. One to two ounces should be used for a sheep, and one-third of this for a lamb.

Muriatic Acid (Spirit of Salt). A powerful caustic, valuable in foot-rot.

Nitrate of Potash (Nitre or Saltpetre). A cooling diuretic. Dose, two drams.

Olive Oil (Sweet Oil). A laxative, though not so good as linseed-oil; useful as an external application in cases of burns or bites from venomous insects.

Opium. A valuable anti-spasmodic and sedative. It may be used either in the form of a gum or powder. Dose, ten grains. It is more usually given in the form of tincture of opium or laudanum. Dose, one to two drams.

Pimento (Allspice). A useful cordial and stomachic. Dose, one to two drams.

Potassa is useful in various forms. Nitrate of Potash has been spoken of. Carbonate of Potash is an excellent antacid; and Chlorate of Potash has been recommended for hoove and as a febrifuge and diuretic. The dose for a sheep is half a dram.

Rye, Spurred (Ergot of Rye). A powerful stimulant to the uterus, and may with this view be given in cases of very protracted lambing. Dose, a scruple infused in hot water, and repeated if required in the course of one or two hours.

Salt (Muriate of Soda). In large doses a purgative, in smaller ones a stomachic and tonic. Sheep are very fond of it; and, in moderate quantities, given with the food, it has a useful effect on the health. It is a good plan to put rock salt in the troughs, so as to admit the sheep licking it when they choose. It has been found to have more effect in counteracting, if not curing the rot, than any other medicine. As a purgative the dose is about an ounce.

Saltpetre. See *Nitre.*

Soda. Carbonate of Soda is an excellent antacid, and Sulphate of Soda or Glauber's Salts, a cooling aperient which may be given for the same purposes, and in about the same doses, as Epsom Salts. Sulphate of Soda is also an excellent antacid, and very useful in cases of tympanites or hoove, the dose being half a dram to a dram in water.

Spirit of Nitrous Ether (Sweet Spirit of Nitre). A diffusible stimulant and anti-spasmodic. Dose, two or three drams.

Sulphate of Copper (Blue Vitriol). A strong tonic, though seldom used in the sheep. Dose, one scruple. Infused in hot water, it makes an excellent astringent lotion.

Sulphate of Iron (Green Vitriol). A useful tonic. Dose, a dram combined with ginger.

Sulphur is largely employed in the manufacture of Sulphuric Acid. There are three qualities imported, and distinguished as first, seconds, and thirds.

Sulphuric Acid (Oil of Vitriol). A very powerful caustic, useful in foot-rot, alone or combined with tar.

Sulphuric Ether. A powerful stimulant and anti-spasmodic. Dose, one dram with warm water.

Sulphur, Sublimed (Flower of Sulphur). An aperient given in combination with Epsom Salts. Dose, one to two ounces. Yellow sulphur is also sometimes used as an external application for the scab in the form of an ointment.

Sulphur Vivum is less pure than the yellow sulphur, but cheaper; its colour is grey, whilst the former is yellow, and it is only used as an external application.

Sweet Spirit of Nitre. See *Spirit of Nitrous Ether.*

Tar. A useful application to the feet in cases simulating or bordering on foot-rot, particularly when combined with sulphuric acid or other caustics. *Oil* or *Spirit of Tar* is also sometimes employed for the same purpose, but it should not be mixed with powerful acids. It is also a good stimulant to wounds, and is commonly applied to the wounds in the skin made in sheep-shearing, and likewise for the fly.

Turpentine. There are several varieties of turpentine. *Common* or *Horse Turpentine* is an ingredient in digestive ointments, but is not administered internally in the sheep. *Venice Turpentine* is a pure and more expensive kind. *Oil* or *Spirit of Turpentine* is a powerful stimulant and anti-spasmodic. Dose, one dram.

Vitriol, Blue. See *Sulphate of Copper.*

Vitriolic Acid. See *Sulphuric Acid.*

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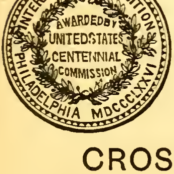

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